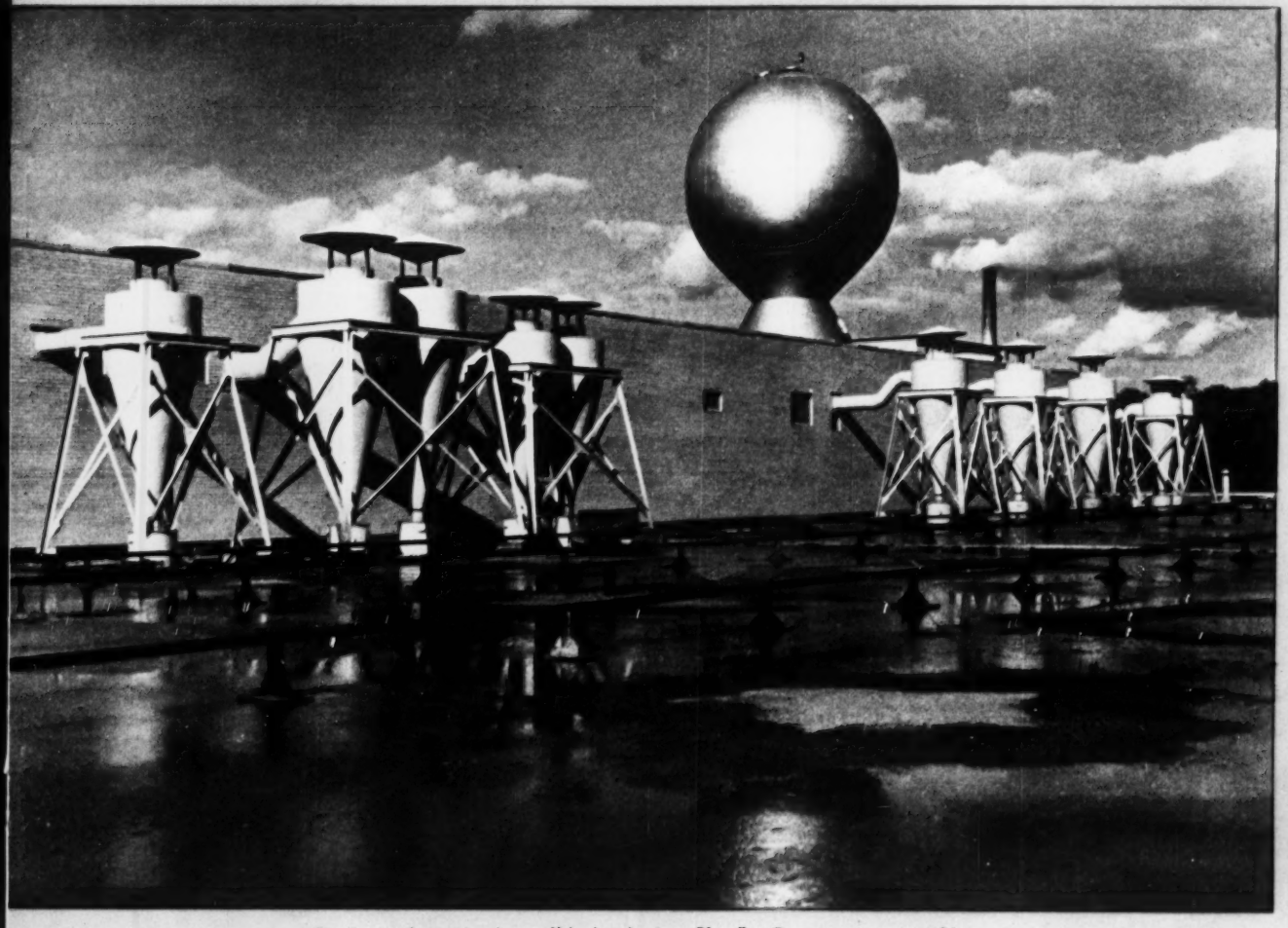
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

JUNE ★ 1953

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 111—Journal Section of The American Society of Heating and Ventilating Engineers



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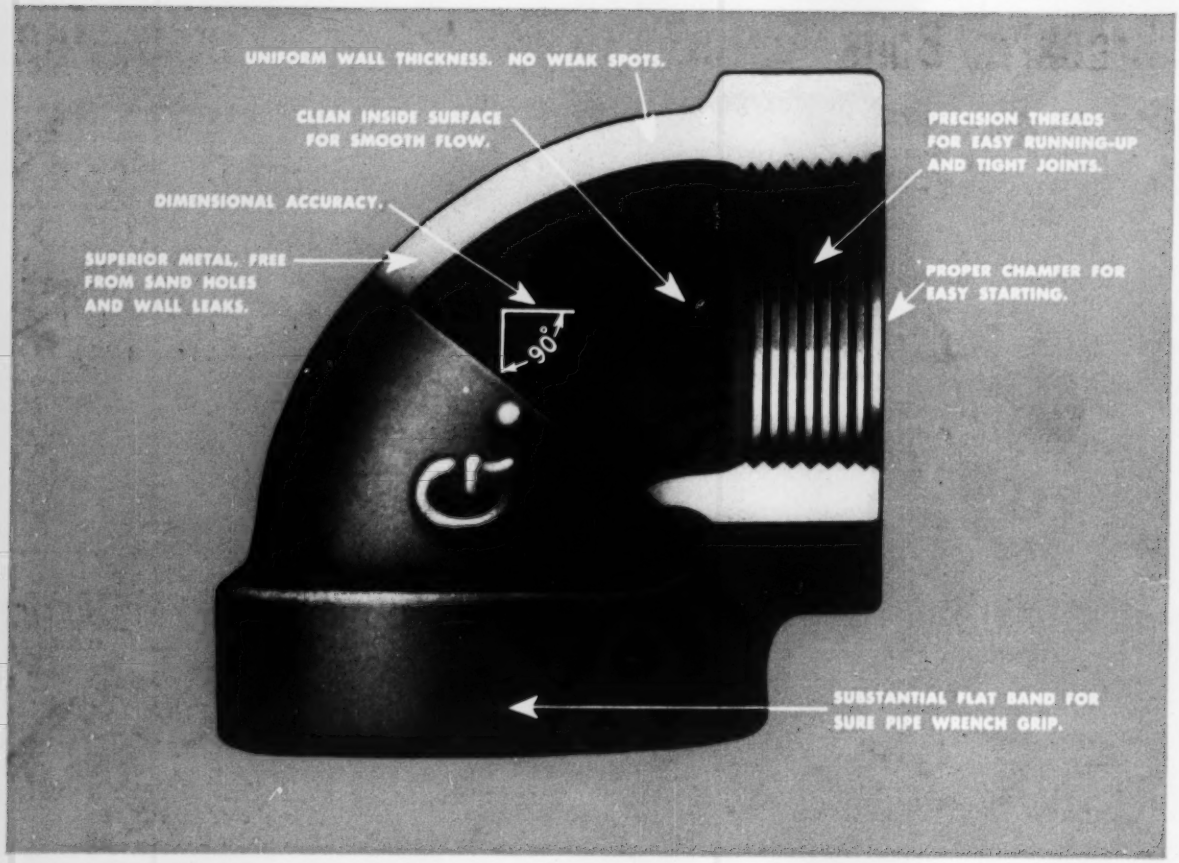
UNIFORM WALL THICKNESS. NO WEAK SPOTS.
CLEAN INSIDE SURFACE FOR SMOOTH FLOW.
PRECISION THREADS FOR EASY RUNNING-UP AND TIGHT JOINTS.
DIMENSIONAL ACCURACY.
SUPERIOR METAL, FREE FROM SAND HOLES AND WALL LEAKS.
90°
PROPER CHAMFER FOR EASY STARTING.
SUBSTANTIAL FLAT BAND FOR SURE PIPE WRENCH GRIP.

Quality control

Comparator checks accuracy of chamfer and threads to assure easy starting, running-up and tight joints.

Modern production methods and triple inspection insure the high quality of

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- Precision threads for easy running-up and tight joints

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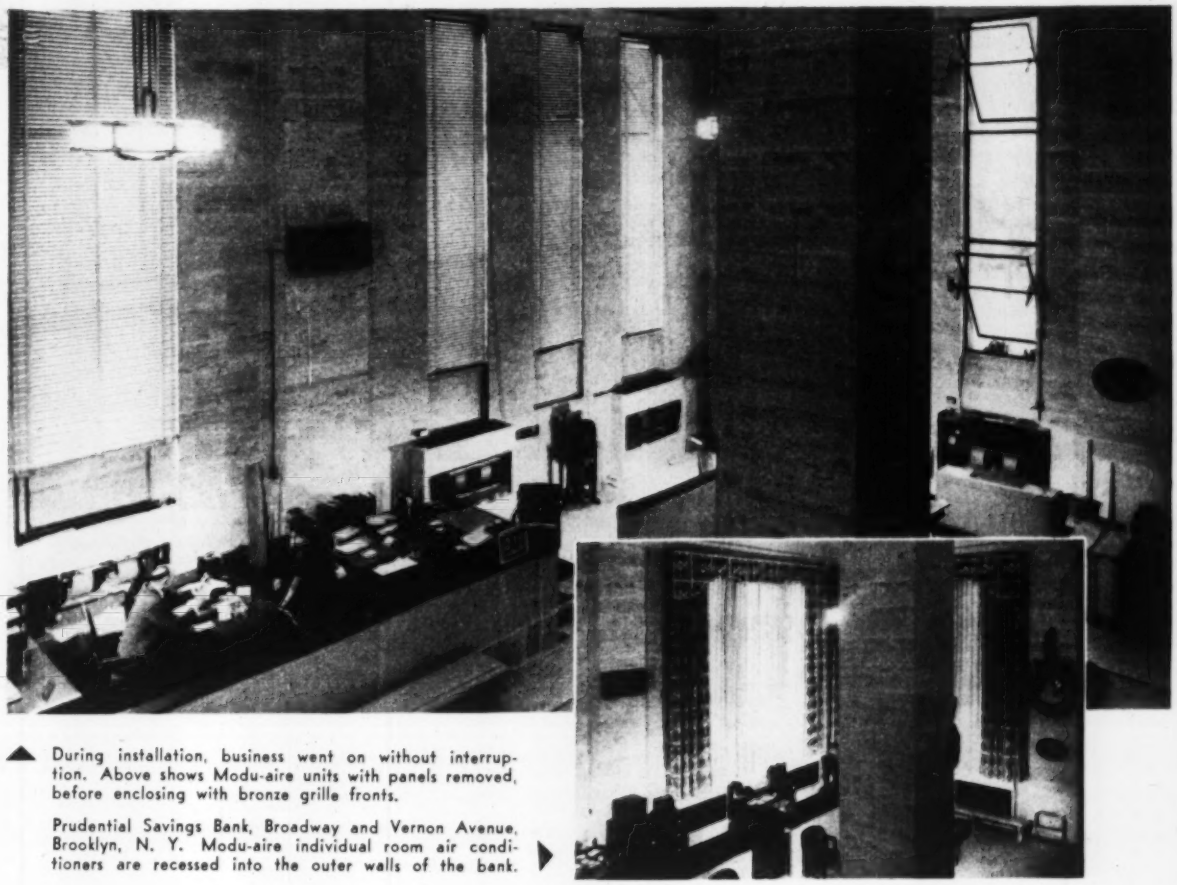
Brooklyn Bank Installs "Invisible" Air Conditioning



▲ During installation, business went on without interruption. Above shows Modu-aire units with panels removed, before enclosing with bronze grille fronts.

Prudential Savings Bank, Broadway and Vernon Avenue, Brooklyn, N. Y. Modu-aire individual room air conditioners are recessed into the outer walls of the bank. ▶

usAIRco Modu-aire Units Provide Year 'round Comfort

Virtually no equipment is visible and no space is lost in the installation of all-year air conditioning in the main office of the Prudential Savings Bank of Brooklyn, New York.

As designed by Frank C. Reynolds, engineer, and installed by the J. M. Fink Company, Inc., the system utilizes 17 United States Air Conditioning Corporation "Modu-aire" unit conditioners recessed into the outer walls of the building on the main banking floor and the mezzanine. The units' panels were removed and enclosed in marble with bronze grille fronts, to blend with the architecture of the bank.

Since the architectural style prohibited the use of ductwork, Modu-aire proved the ideal installation. Piping is concealed in the walls and carries cold water to each unit for summer cooling . . . and transports hot water to each unit for winter heating.

Two 750 c.f.m. units in the rear wall take in fresh air. Another Modu-aire unit is free standing, located in the main office area where it cannot be seen by the public.

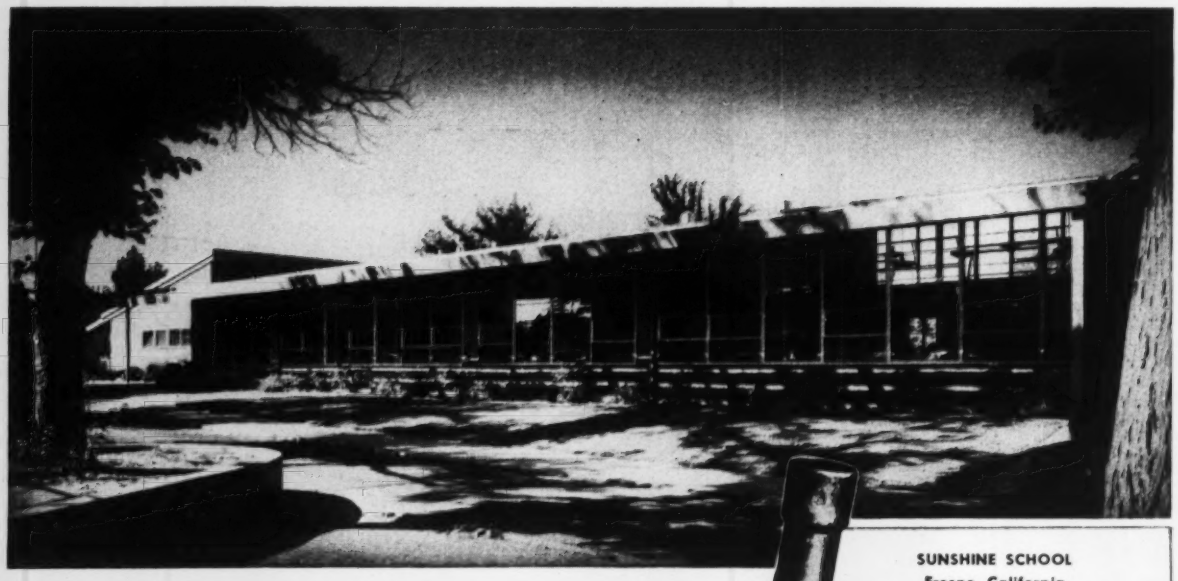
The conditioned area is divided into eight zones, each controlled by its own thermostat.

The installation was carried on as a part of a general remodelling program by the bank, which maintained business as usual during the entire operation. Kenneth B. Norton was the architect . . . the general contractor for the renovation work, Phineas Zolot.

for descriptive literature on Modu-aire write Dept. HP 653

UNITED STATES AIR CONDITIONING CORPORATION
MINNEAPOLIS 14, MINNESOTA

usAIRco
30 YEARS OF AIR CONDITIONING



SUNSHINE SCHOOL
Fresno, California

ARCHITECTS—David H. Horn—Fresno, Calif.
M.D. Mortland, Fresno, California

ASSOCIATE ARCHITECTS—C. C. Ternstrom
Los Angeles, California

MECHANICAL ENGINEER—Gordon S. Stiles
Fresno, California

MECHANICAL CONTRACTORS, STAGE 1
Grenfell & Hunter, Fresno, California

MECHANICAL CONTRACTORS, STAGE 2
Fresno Plumbing & Heating Co., Fresno, California

BYERS WROUGHT IRON PIPE

safeguards welcome warm comfort in radiant heated SUNSHINE SCHOOL

In this prize-winning school (three awards from AASA, one from AIA) every consideration was given to the comfort and convenience of the crippled children it was designed to serve. Extra large door openings, all floors on one level, open-front sinks and work counters and a host of other design solutions reflect the careful planning that went into every detail.

This same care and planning was extended to the heating system. Even, controlled warmth was a "must." The designers answered the need with a radiant heating system. To safeguard the heating system from the health and economic threat of premature failure, Byers Wrought Iron pipe was used for the heating coils.

Protecting radiant heating systems in schools with Byers Wrought Iron pipe is a continuing practice with David H. Horn & M. D. Mortland, architects for famous Sunshine School. Since the introduction of radiant heating, this architect team has employed the system, using Byers Wrought Iron pipe, in fifty schools in the California area.

There are good reasons for this confidence, which is shared by an increasing number of the nation's leading architects. Byers Wrought Iron pipe is readily formed and welded which speeds and simplifies radiant heating installation. It has a high rate of heat emission. It expands and contracts at practically identical rates with concrete. Its mechanical strength withstands damage during installation. And its corrosion resistance has been demonstrated time and time again, over periods of many years.

Our bulletin, BYERS WROUGHT IRON FOR RADIANT HEATING, gives the complete story. Write for your copy.

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This notch-fracture test specimen illustrates the unique fibrous structure of genuine wrought iron—which is responsible for the high corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

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WROUGHT IRON

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ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 25 No. 6

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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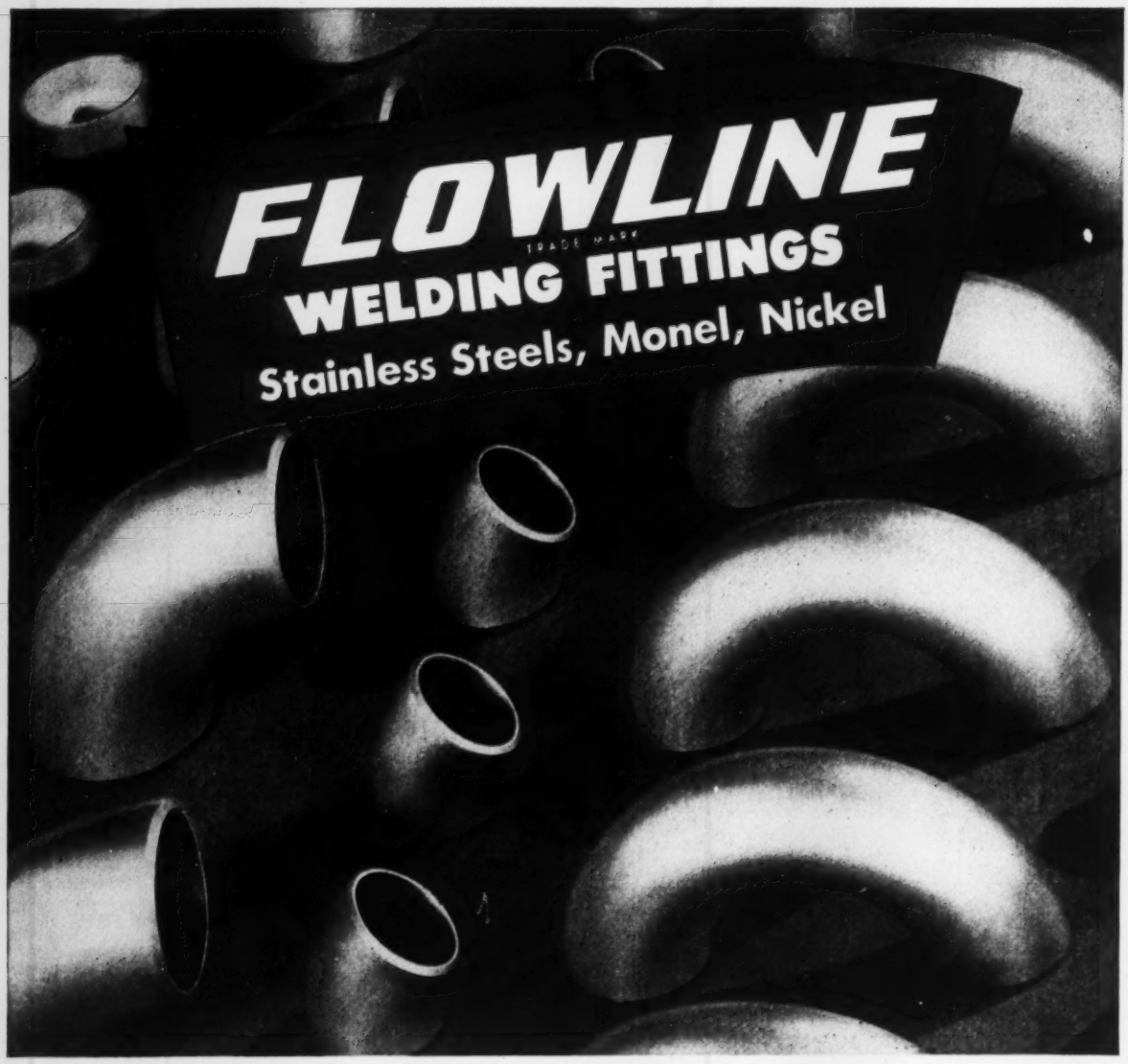

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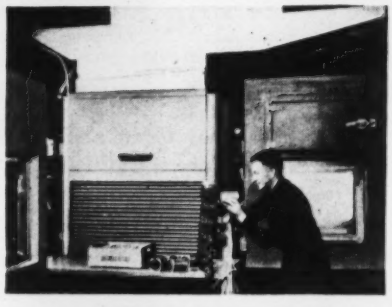
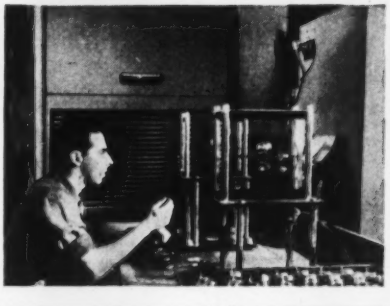
By "zoning" this space, each UNITAIRE cools and dehumidifies its assigned area. This gives uniform air conditioning even though heat and moisture-producing operations on the floor vary. And Unitaire Conditioners are easily moved as production layouts change.

You can get the UNITAIRE now from your Westinghouse Air Conditioning Distributor's stock. Call him today. He's listed in the Yellow Pages of your telephone directory. Westinghouse Electric Corporation, Air Conditioning Division, Hyde Park 36, Massachusetts.





Where heat and humidity hamper skilled hands, a UNITAIRE gives constant temperature-humidity control. That's why Quinn Engineering Co., New York, has added ten more units to another Kollsman plant this year. Completely built by Westinghouse with its own proved parts, the UNITAIRE gives trouble-free service and economical operation.

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YOU CAN BE SURE...IF IT'S Westinghouse

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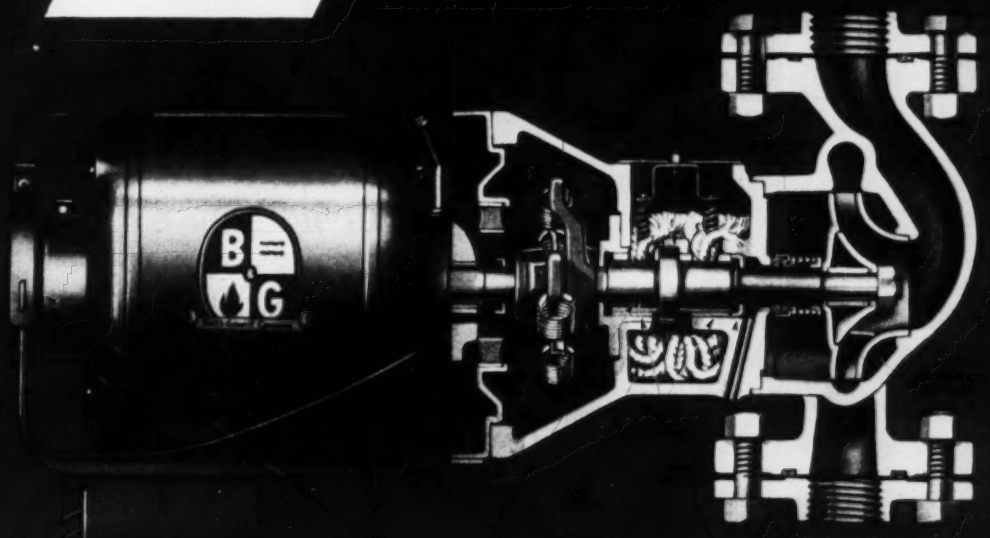
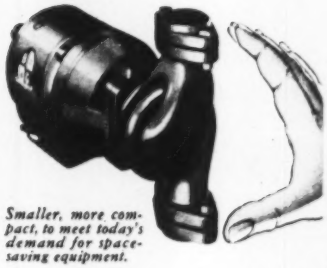


COMPARE THE B&G BOOSTER POINT BY POINT



Smaller, more compact, to meet today's demand for space-saving equipment.

One look is enough to show you why more B & G Boosters are sold than any other pump made for the same purpose. In every detail the Booster is precision-built... for failure-proof performance... long life.

Leak-proof seal. Precision-ground ... positively prevents water leakage into bearings.

Shaft and bearings. Shaft is hardened, polished steel. Bronze bearings are diamond bored... *extra long* for quiet, long-lived operation.

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Spring-type Coupler. Simple, dependable... contributes to quiet operation. Shielded for safety.

Impeller. A true centrifugal design... balanced for smooth operation.

Motor. Specially designed and built to operate quietly. ¾", 1" and 1¼" Boosters have 1/12 H.P. motors but have exactly the same pumping capacity as previous models with larger motors.

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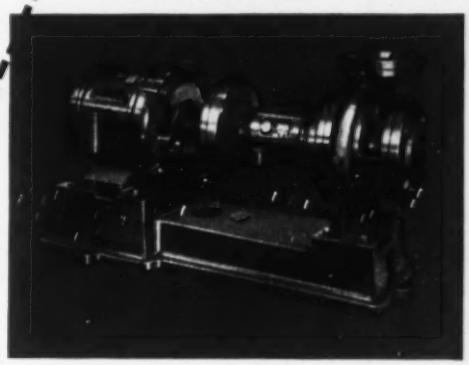

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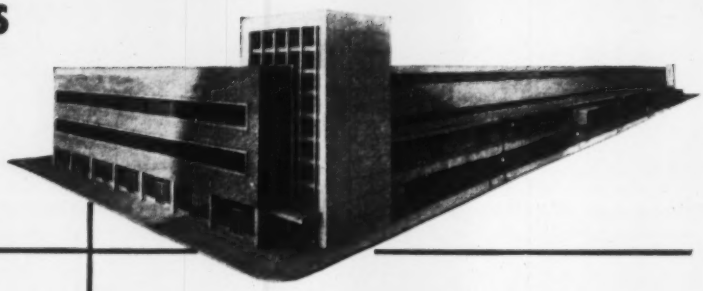

Pennsylvania Duquesne Warehouse, Pittsburgh, operated by Pitt-Penn Terminal Company. Hunting, Larsen & Dunnells, architects; T. F. Rockwell, mechanical engineer; Sauer, Inc., mechanical contractors, all of Pittsburgh.

To provide the best in warehouse and shipper service, the Pennsylvania Railroad constructed this four-block-long warehouse and terminal building, which is operated under lease by the Pitt-Penn Terminal Company.

This interesting building is another example of the adaptability of Johnson Automatic Temperature Control. The offices are heated by radiant panels which are under the control of a Johnson Master-Submaster System, regulating the steam supply to hot water converters. This weather-compensated system supplies the floor panels with hot water at just the right temperature, as dictated by the outdoor temperature. Convectors throughout the building are under the control of a similar weather-compensated system. Offices and store rooms along Twelfth Street have individual room control, with provision for future cooling.

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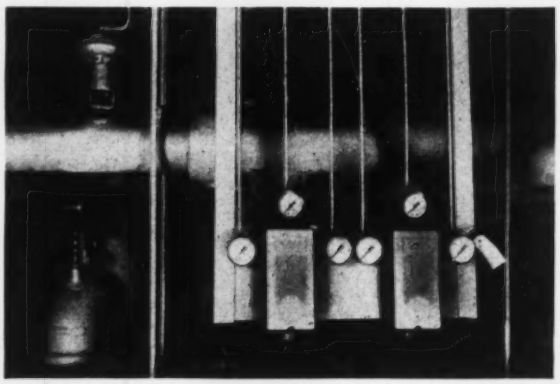
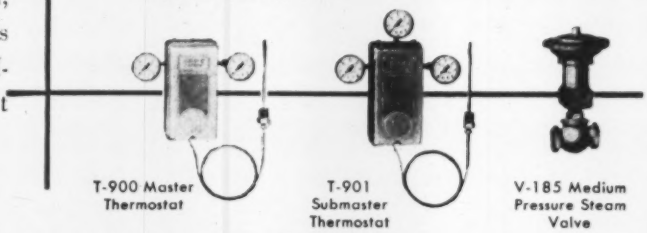


Johnson Valves, operated by Johnson Submaster Thermostats, control the steam supply for hot water converters.

In office sections, hot water temperatures in radiant floor panels are varied automatically to compensate for outdoor temperature changes.



T-900 Master Thermostat

T-901 Submaster Thermostat

V-185 Medium Pressure Steam Valve

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

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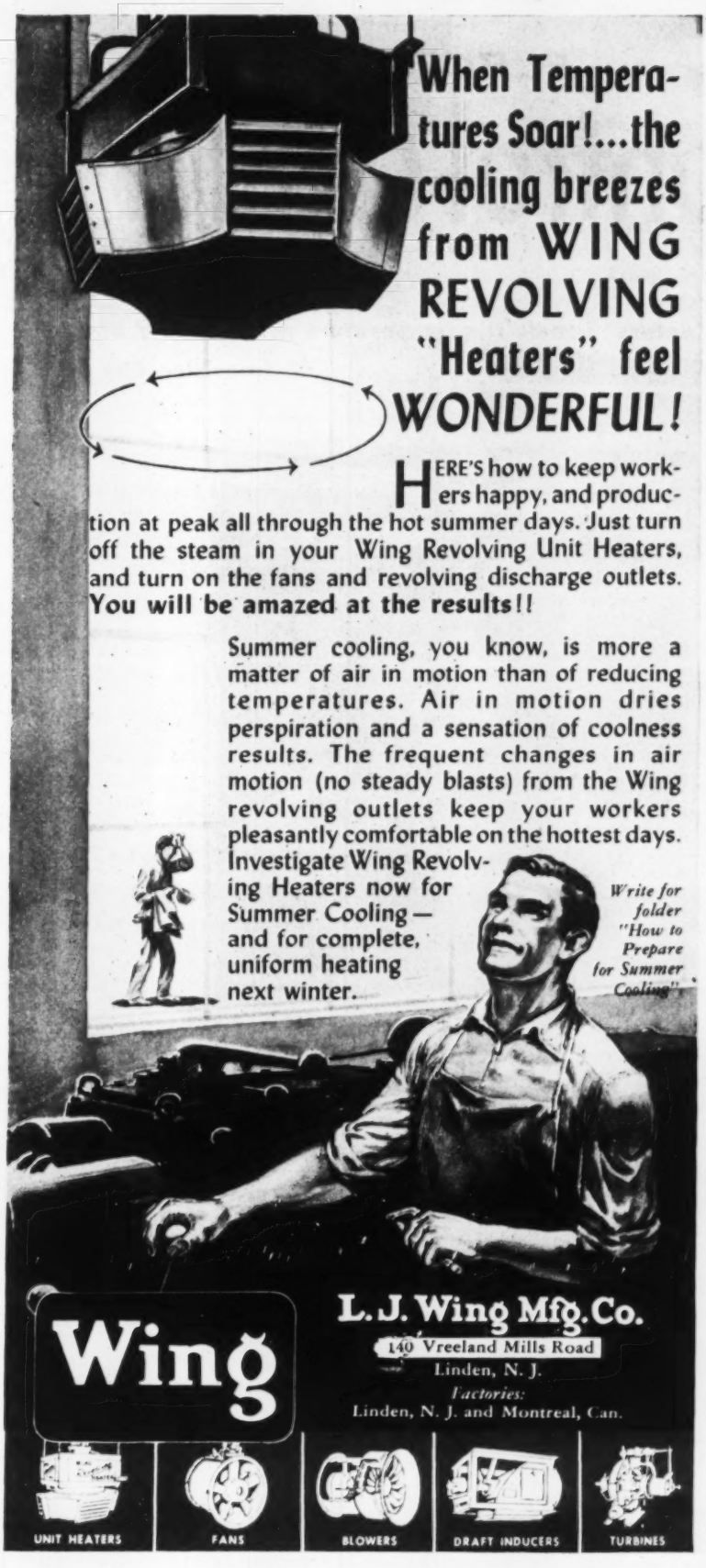
When Temperatures Soar!...the cooling breezes from WING REVOLVING "Heaters" feel WONDERFUL!
HERE'S how to keep workers happy, and production at peak all through the hot summer days. Just turn off the steam in your Wing Revolving Unit Heaters, and turn on the fans and revolving discharge outlets. You will be amazed at the results!!
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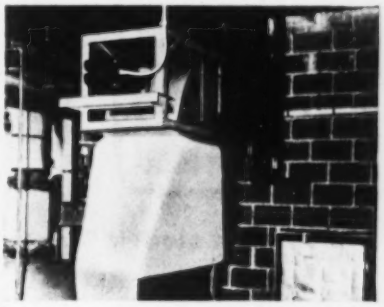

with the WING DRAFT INDUCER

No boiler can operate satisfactorily or efficiently over wide ranges of weather or load with variable natural draft. The fuel—whether oil, gas or coal—must have enough oxygen for complete combustion. There must be sufficient draft or furnace fires will be slow burning and lifeless, resulting in uneven, insufficient and irregular heat.

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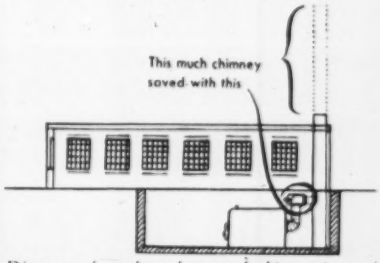


Diagram above shows how much chimney is saved by installing Wing Draft Inducers.

Wing Draft Inducers are suitable for use in connection with oil, gas, stoker-fired or hand-fired heating boilers, industrial furnaces or kilns, or high pressure steam boilers, either stationary or marine. Sizes are available for boilers as low as 1000 sq. ft. E. D. R. up to steam generators producing 100,000 pounds of steam/hr. Special, heavy duty designs available for these larger boilers.

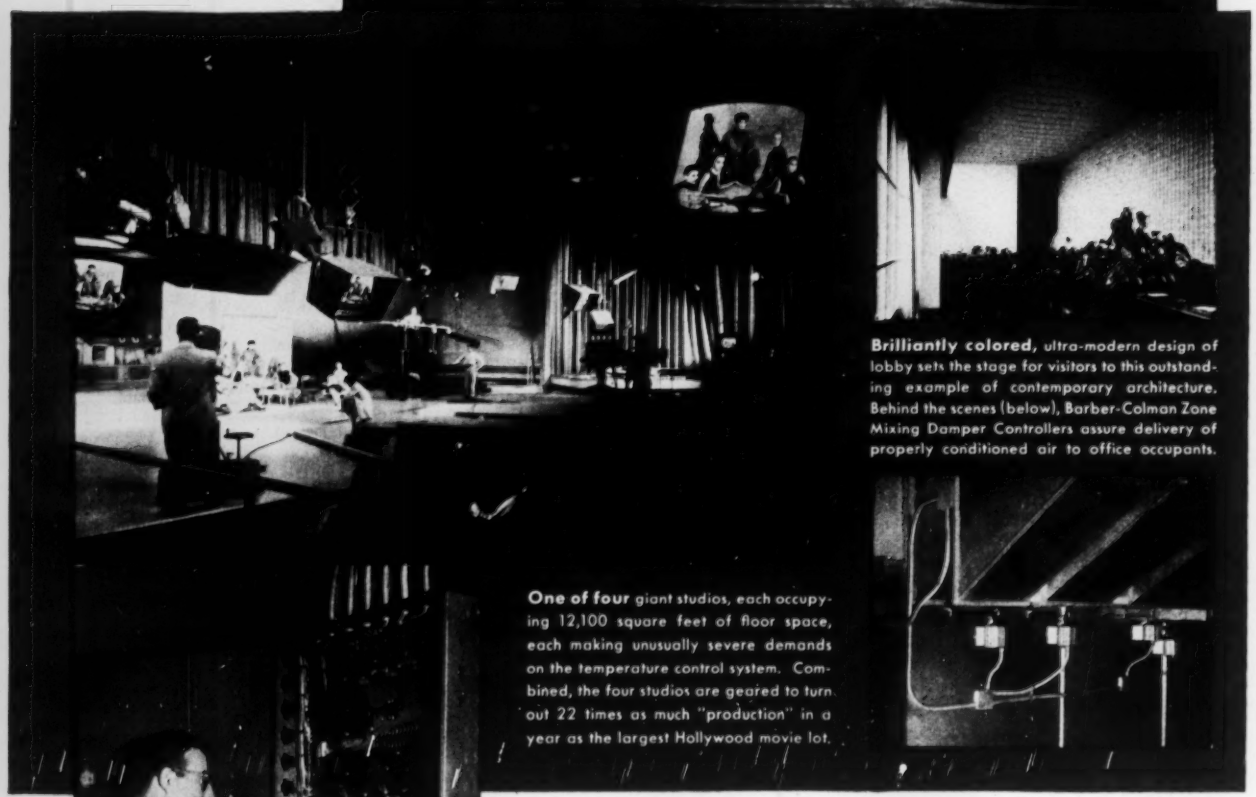
Wing Draft Inducers are made in two types—for insertion in breeching or flue, or for installation on top of a chimney. Write for a copy of Bulletin I-52 to L. J. Wing Mfg. Co., 140 Vreeland Mills Road, Linden, New Jersey.

BARBER COLMAN

ELECTRIC Control Center

10 modern electric "Control Centers" handle the temperature requirements of CBS Television City

CBS Television City, Los Angeles, world's largest television plant. Architects and engineers: Pereira & Luckman. General Contractor: Wm. Simpson Co. Air Conditioning and ventilating contractor: Kilpatrick & Company—all of Los Angeles, Calif.



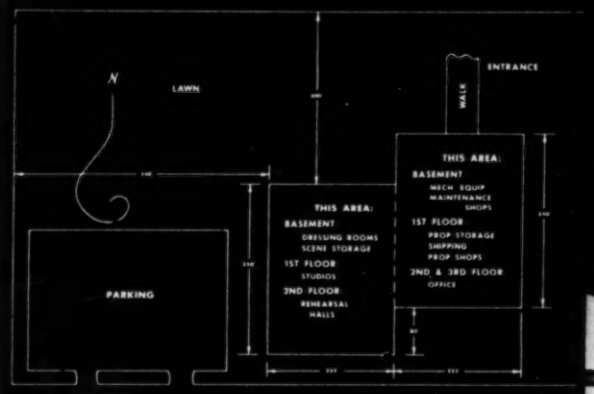
Brilliantly colored, ultra-modern design of lobby sets the stage for visitors to this outstanding example of contemporary architecture. Behind the scenes (below), Barber-Colman Zone Mixing Damper Controllers assure delivery of properly conditioned air to office occupants.

One of four giant studios, each occupying 12,100 square feet of floor space, each making unusually severe demands on the temperature control system. Combined, the four studios are geared to turn out 22 times as much "production" in a year as the largest Hollywood movie lot.

10 "Control Centers" *throughout building simplify installation, reduce costs, permit utmost flexibility for differing needs of each section of the "City." Each Barber-Colman "Control Center" houses prewired accessories—switches, relays, transformers, resistors, etc.—and numbered terminal strips for connecting all components of each electric control system. Each system can be checked, revised, or added to at its own "Control Center."*

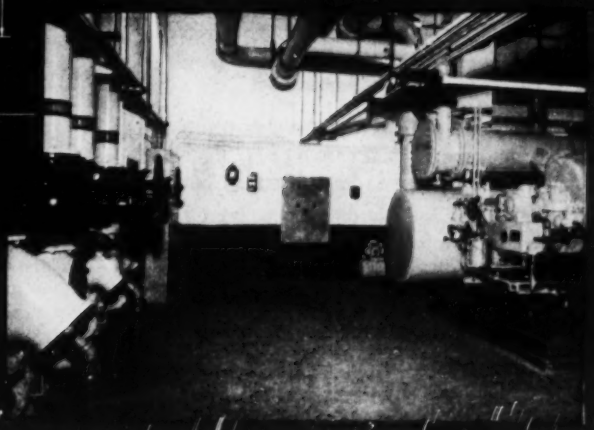
Television "City" aptly describes this unique new CBS Television production unit. Within its walls are practically all the ordinary activities encountered in a small city—plus some unusual demands on temperature control systems. It's a factory with paint shops, carpenter shops, design shops, production lines . . . an office building . . . a multiple auditorium with four huge studios, three tremendous rehearsal halls. It has 12,000 feet of exterior all-glass walls, covers 8½ acres—374,620 square feet of floor space. It's a home for hundreds of people, virtually around the clock.

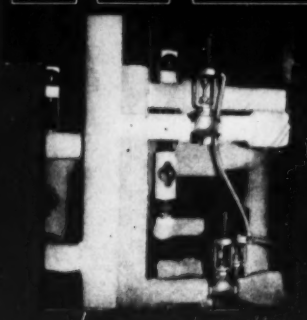
Air handling requirements called for advanced engineering experience and techniques. Sixteen fan rooms located throughout the building meet the heating, ventilating and air conditioning requirements. (Terrific heat peaks result from concentrations of light and electronic equipment.) All controls, from individual room Microtherms to three-way valves in the heating and cooling systems, are electric. All of them are components of ten Barber-Colman "Control Center" systems. Completed temperature control systems are as modern in appearance, as improved in function, as the building design. The complete story of this and other outstanding "Control Center" installations is readily available from your nearby Barber-Colman field office. For quick action, phone, or send coupon below.



Drawing (left) portrays wide range of activities centered in Television City. Flexibility of electric controls permits handling of each different temperature requirement with maximum results, minimum costs.

Partial view (below) of one centrifugal compressor and chiller at right, water pumps at left. On wall in background is one of the ten modern electric Barber-Colman "Control Centers."





Three-way motor-operated proportioning valves and two-way change-over valves handle flow of both hot and chilled water without mixing for studio conditioning.

BARBER COLMAN

ELECTRIC

Control Center

Automatic Controls • Air Distribution Products • Industrial Instruments
Aircraft Controls • Small Motors • OVERdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

BARBER-COLMAN COMPANY, ROCKFORD, ILL., U. S. A.
DEPT. G, 1601 ROCK ST.

Gentlemen: Send me more information about the CBS Television City installation and details of your "Control Center."

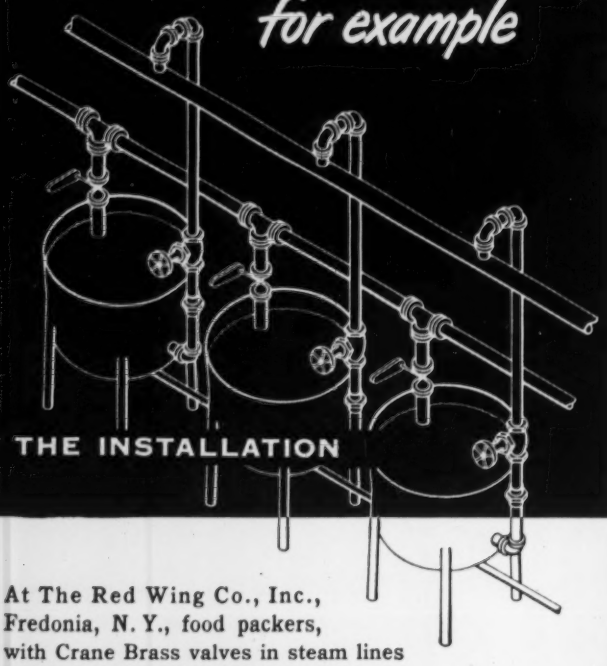
Individual _____

Firm Name _____

Address _____

City _____ *State* _____

How Better Quality Valves Pay Off ...on Steam Throttling, for example



THE INSTALLATION

At The Red Wing Co., Inc., Fredonia, N. Y., food packers, with Crane Brass valves in steam lines to juice heaters and cooking kettles.

VALVE SERVICE RATINGS

SUITABILITY:	None better for throttling
MAINTENANCE COST:	No expense here
SERVICE LIFE:	No sign of wearing out after 4 years
OPERATING RESULTS:	Precise control of steam to cookers
PRICE:	Bigger value than any other valve used
AVAILABILITY:	Regular Crane Catalog Item - No. 212P

THE CASE HISTORY

At least once a week there was valve trouble in the cooking room. Leaky valves . . . disc and seat cut out . . . steam to kettles out of control.

New valves made little difference; none could stand the severe steam throttling. Not until Crane plug-type disc valves were installed.

Immediately the valve trouble stopped as did the cooking interruptions. Not even the plant operator believed it possible. In use now more than 4 years with no maintenance cost, the Crane No. 212P valves are still in like-new condition. They show no erosion, no leakage; and they operate freely.

THE VALVE

Designed expressly for severe throttling service, these Crane brass valves have plug type disc and seat of Crane Nitri-Hard stainless steel. Seating surfaces are practically impregnable to damage by cutting, erosion, etc. Disc taper permits close flow regulation. For any kind of throttling look into these valves for 150, 200, and 300-pound steam services. Your Crane Catalog or your Crane Representative will give you all facts.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

like these rugged INDUSTRIAL EXHAUSTERS

Supplying primary and secondary air for a lime kiln is a job calling for constant pressure and twenty-four hour reliability. "Buffalo" Industrial Exhausters have proven themselves ideal for such service. All-welded heavy steel plate housings and rotors give them ample strength and rigidity. Note the extra-heavy shafts and large bearings to take the torque and thrust. Available with either Material Wheels or Air Wheels, these fans have earned a reputation as the "work fans of industry", on every type of exhaust and pneumatic conveying job, as well as mechanical draft.

"Buffalo" Industrial Exhausters may be had in high-heat models, rubber-lined, coated or alloy construction for handling corrosive and/or abrasive atmospheres.

For fans that will perform as rated, and that will stand up on the job, specify "Buffalo". Why not write for recommendations on *your* air application?

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

171 MORTIMER ST. BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING

FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Now! Install air conditioning

READY TO INSTALL . . . the new TRANE Cold-Generator is a complete mechanical refrigeration machine—wired, piped, refrigerant-charged . . . all interconnected for immediate comfort or process cooling applications.

new TRANE Cold-

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING AND VENTILATING EQUIPMENT

. . . as easy as heating!

Easy to install! New packaged water chiller . . . wired, piped, refrigerant-charged at the factory. All you do is make simple piping and wiring connections!

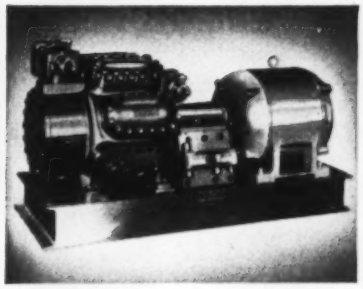
If you've decided to expand with the growing air conditioning business . . . here's your chance! Now you can install complete mechanical refrigeration for air conditioning systems in hotels, office buildings, motels, theaters, stores . . . everywhere . . . with the new TRANE Cold-Generator. All the refrigerant piping, wiring, evacuating, dehydrating and charging is done for you at the factory.

The new TRANE Cold-Generator is a complete liquid chiller in one compact assembly. Built in 6 sizes from 10 tons up. Delivered ready-to-run as soon as simple plumbing and electrical connections are made.

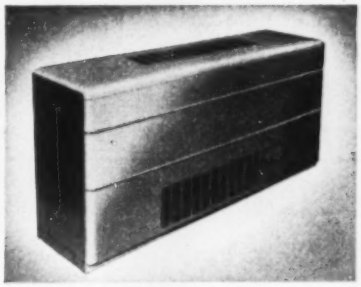
Here's what you get. Compressor and motor, condenser, insulated dry expansion chiller, insulated heat exchanger, refrigerant piping, safety valves, wiring and automatic controls. Everything is there . . . carefully engineered, exactly matched, completely assembled.

Get full information at once. See how the new TRANE Cold-Generator is as easy to install as a heating system . . . can be installed for process or comfort applications. See for yourself how this new packaged refrigeration machine can bring you packaged profits! Contact your TRANE representative or write to TRANE, La Crosse, Wis.

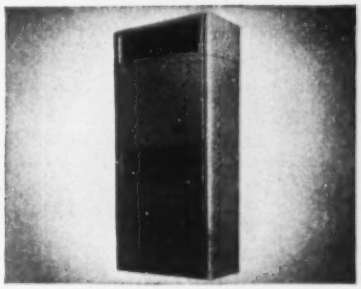
NO JOB TOO LARGE OR TOO SMALL FOR TRANE AIR CONDITIONING EQUIPMENT



For jobs from 3 to 50 tons, the TRANE Reciprocating Compressor packs maximum performance into minimum space. Factory assembled. Easy to install. Available with shell-and-tube condenser above compressor.



UniTrane units give tenants complete room-control of air conditioning. One standard piping circuit supplies units with hot water in winter . . . chilled water in summer from TRANE Cold-Generator or larger CenTraVac.



In a package—TRANE Self-Contained Air Conditioners require only simple piping and electrical connections. Capacities from 3 to 20 tons. Water-saving evaporative condenser optional in the 10, 15 and 20-ton models.

Generator *brings you comfort or process cooling . . . in a package!*

The Trane Company, La Crosse, Wisconsin • Eastern Manufacturing Division, Scranton, Pennsylvania • Trane Company of Canada, Limited, Toronto • 87 U.S. and 14 Canadian Offices

Here's Help on Your

Allis-Chalmers application engineering help plus coordinated design of Allis-Chalmers motors, control and *Texrope* V-belt drives saves you engineering and installation expense and time . . . assures a trouble-free job.

AIR CONDITIONING CONTRACTORS LIKE Allis-Chalmers complete drives because they can save money and still assure the customer of a top quality job without service problems. Allis-Chalmers District Office representatives understand the problems of air conditioning contractors and offer them help in engineering exactly the right drive for the application. Since all parts of the Allis-Chalmers drive are of coordinated design and manufacture, they match up and fit together quickly and easily. And buying from a single source is less trouble . . . means that all components arrive on the job together, ready to be installed.

Nation-wide Stocks

Allis-Chalmers District Offices and Authorized Distributors maintain adequate stock of all equipment commonly used in air conditioning installations. No matter where you are located, most items can be delivered within 24 hours. An efficient warehouse inventory system can locate hard-to-get items in a few hours.

Certified Service

Nearly every industrial area in the country has one or more Allis-Chalmers Certified Service Shops . . . independent service shops which meet Allis-Chalmers high standards for modern equipment, efficient methods and business integrity. These shops assure your customer of factory-approved parts and service.

For lower engineering and installation cost . . . for one reliable guarantee of satisfaction on the complete drive unit . . . for quick delivery and top notch service . . . make your next drive Allis-Chalmers.

Send for Free Engineering Literature

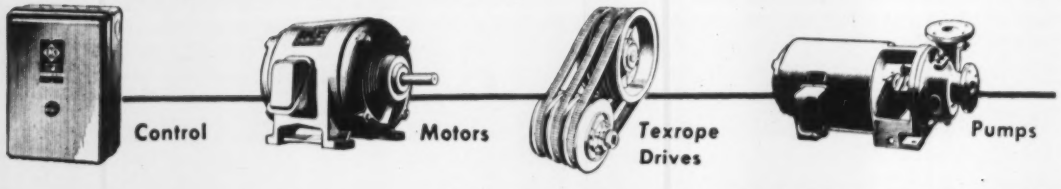
Motors
- ☐ Handy Guide to Motor Selection 51B6052
- ☐ Squirrel-Cage Motors 51B6210

Control
- ☐ Handy Guide to Starters 14B7733
- ☐ Reduced-voltage Starters 14B7215

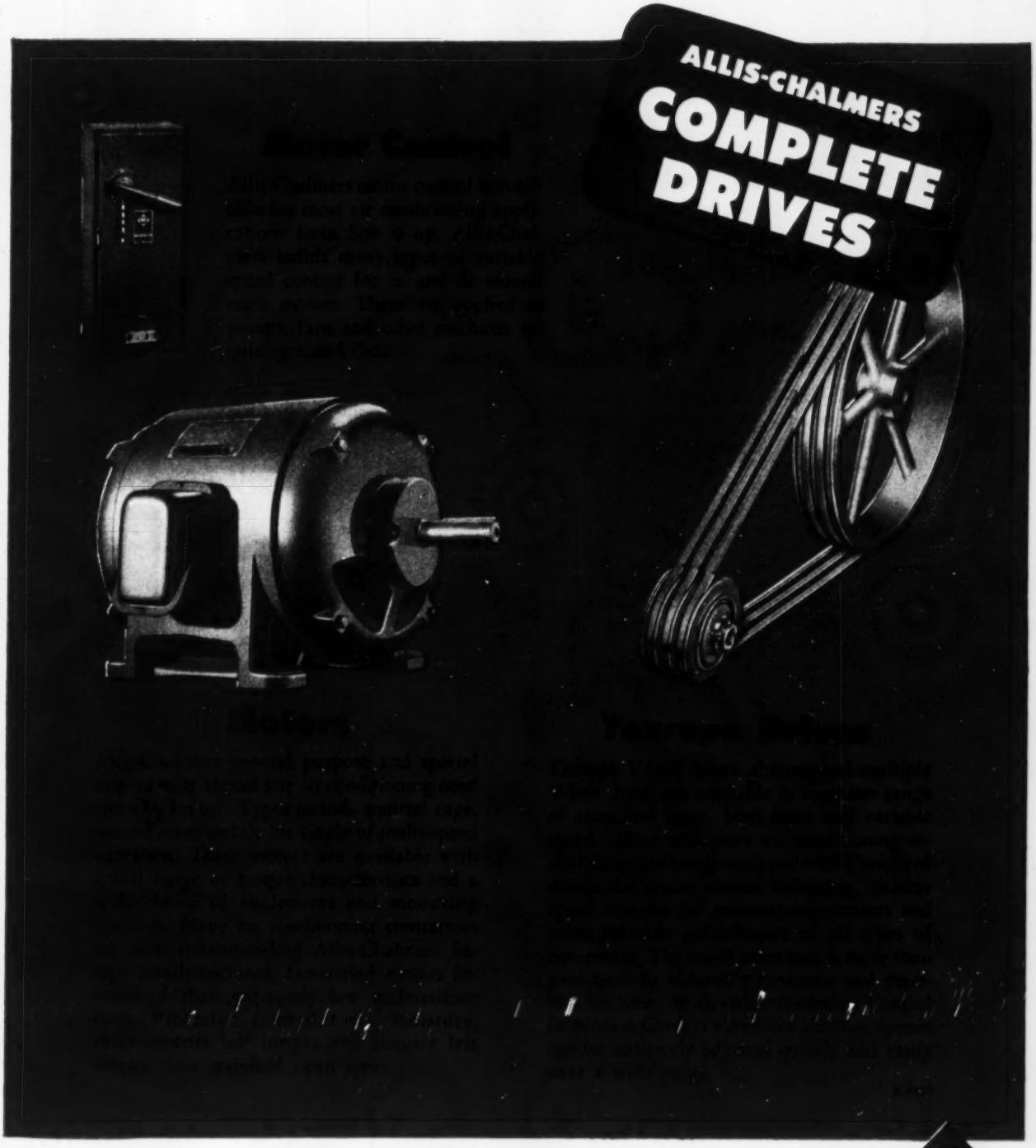
***Texrope* Drives**
- ☐ Handy Guide to *Texrope* Drives 20B6051
- ☐ *Vari-Pitch* Drive Engineering Data 20B7499

Allis-Chalmers, Milwaukee 1, Wisconsin

COMPLETE SERVICE *from power line to machine*



Drive Problems



Texrope and *Vari Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

"Buffalo" Tips on Better Pumping

5 WAYS to get the Most From Your PUMPING INVESTMENT

1. Match The Pump To The Conditions

First, determine all possible conditions of the liquid to be pumped — chemical analysis, suction lift (if any), head or pressure, specific gravity and temperature of liquid — then pick the exact pump made for those conditions. (In the "Buffalo" line, you'll *find* that "ideal" pump, because the line is so complete.)

2. Save On First Cost By Using Highest Recommended Driver Speed

The higher the speed, the more the pump will deliver — within reason — and the smaller the pump you can use for a given job. But be sure to operate at no higher than recommended speeds. Overspeeding wears out any pump.

3. Right Installation Aids Performance

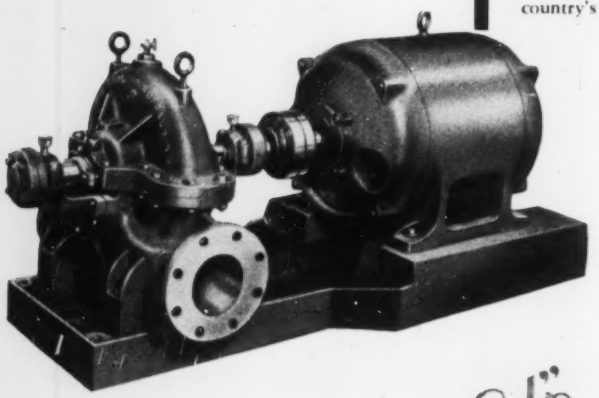
Give your pump the best chance — install close as possible to liquid supply source — keep pipe friction losses to a minimum — be sure suction line has no humps or hollows which could cause air locks. (You'll find "Buffalo" Pumps compactly built and easy to install)

4. Regular Maintenance Schedule Lengthens Pump Life

Regular inspections and servicing of bearing lubrication, shaft alignment, packing, impeller not only keep your pumps running smoothly, but head off minor conditions which could develop into problems later on. (You have a long-life "bonus" to start with if your pumps are "Buffalo"!)

5. A Quality Pump Is Always An Economy — Specify "Buffalo"

No installation can be better than its pump. For known quality that means long life, efficient performance and simple maintenance, pick the pumps used in many of the country's largest installations — "Buffalo" Pumps.



"Buffalo" Type SL Pump

for high-volume, high-efficiency clear water service, as air washing, chilled water or other air conditioning service. A double suction design with enclosed, hydraulically balanced impeller. 10 to 10,000 gpm capacities. *Write for bulletin 955.*

BUFFALO "Buffalo" PUMPS, INC.

171 MORTIMER STREET BUFFALO, N. Y.

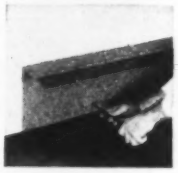
Subsidiary of Buffalo Forge Company

Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

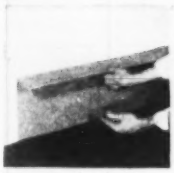
A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

All KRITZER Fin-pipe radiation* is easy to install

*KRITZER BASEBOARD

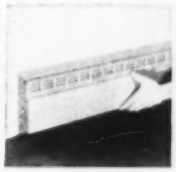


1 Attach Back Plate to wall with suitable screws or bolts.



2 Attach Support Brackets or Wire Hangers and Bottom Spacers.

3 Lift Fin-Tube Coil into place for piping connections.



4 Attach Cover Plates, with or without Dampers, as required. All Front Covers snap into place without screws or tools.

5 Attach Accessories such as End Enclosures, Joint Covers, Corners. All clip into place and require minimum of screws.

*KRITZER RADIANT PANEL

1 Coil Sections are suspended and automatically positioned by Kritzer Red Head Hangers, which are placed on every other joist. Ends of tubes are then cleaned and fluxed for soldering.

2 A solder ring is inserted into each expanded tube end, and the tubes are put together and quickly soldered, as shown. No connecting couplings are required. A noise-eliminating aluminum-and-asbestos sleeve is next wrapped around each joint that is held by a hanger.

3 The hanger ends are now bent up. This simple action snaps the Coil Sections up into position between the joists, where they remain.

*KRITZER FIN-PIPE

1 With suitable screws or bolts fix brackets to wall at intervals to suit the coils involved. Two screws will hold 1, 2 or 3 row high brackets. Proper alignment of the Kritzer adjustable hangers will insure time saved in completing the installation. Center the hangers in spaces on coils provided for this purpose.

2 Insert coil section in large notches on mounting brackets and make pipe connections.

3 Catch lower lip of cover in small notches on bottom edge of mounting brackets. Then push cover up and back, and snap into place with upper lip of cover in small notches at upper rear of mounting brackets. Attach joint covers or end enclosures.

SEE YOUR JOBBER FOR KRITZER PRODUCTS

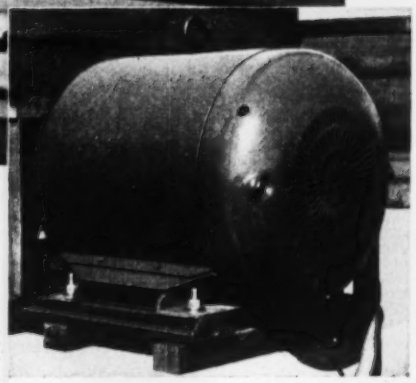
KRITZER RADIANT COILS, Inc.

IF IT'S KRITZER, IT'S RIGHT, SIR!

2901 Lawrence Avenue, Chicago 25, Illinois

*KRITZER BASEBOARD HEATING
KRITZER RADIANT PANEL HEATING
KRITZER FIN-PIPE HEATING

8 cell cooling tower driven by 8 Wagner Multi-speed Motors.



Here's a job for *Rugged* motors

This 8 cell Marley Cooling Tower, at Pueblo, Colorado, provides a steady supply of 6600 gallons of cooling water per minute for a steam power plant. There are 8 fans with blades 22 feet in diameter that are driven, through gear reducers, by 8 Wagner two-speed, totally-enclosed fan-cooled motors. These 440 volt motors are each rated 75/19 hp.

Cooling towers need motors with plenty of stamina. They must operate without attention, day in and day out, completely exposed to all kinds of weather.

Wagner totally-enclosed fan-cooled motors are built to operate under severe conditions. They are available in steel or cast iron frames, in standard or explosion-proof types, single-speed or multi-speed, single phase, 2 phase or 3 phase, in ratings to 250 hp.

For your requirements, there is a Wagner Motor to fit every need—a complete line for all current specifications, with a wide variety of enclosure types and mountings. Bulletin MU-185 gives full information. Do you have a copy?

Your nearby Wagner engineer will be glad to help you select the *right* motors for your next application. Call the nearest of our 32 branch offices, or write us.

® Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

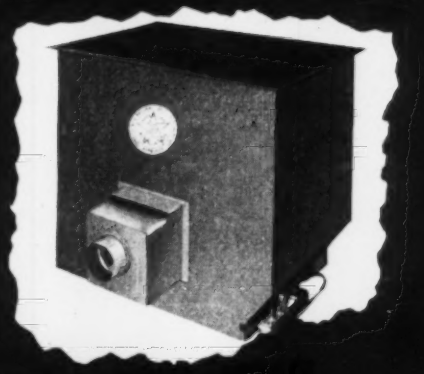
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

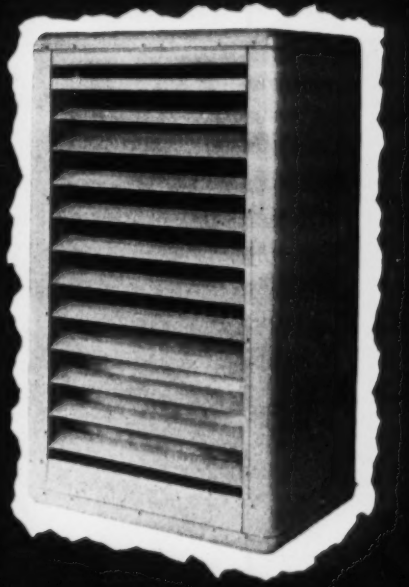
BRANCHES IN 32 PRINCIPAL CITIES

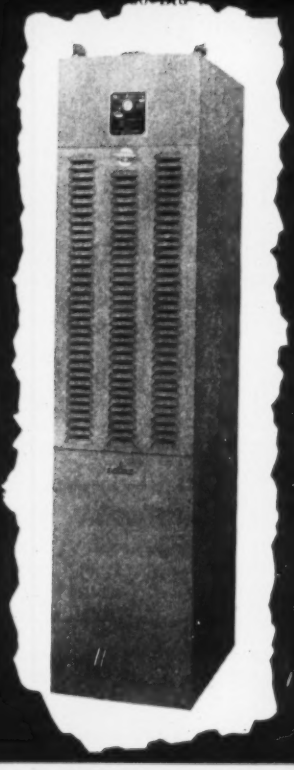
M53-18

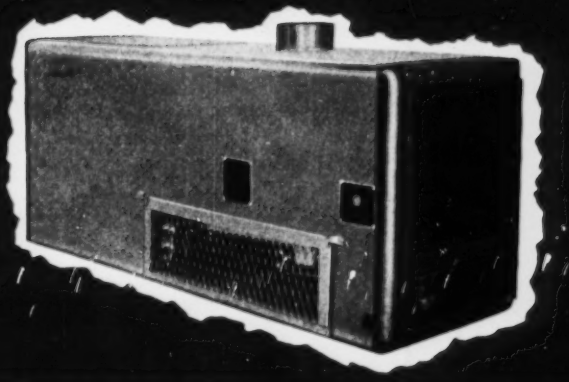
A John Zink Heat Motor for Any

DOMESTIC INSTALLATION









Write for Literature

JOHN ZINK

Two *New* examples of Wolverine's SPUN END PROCESS*

Designed to reduce both production cost and operating cost . . .

BOTH of these typical examples are driers used in the refrigeration industry. Starting with a basic tubular form of a certain length, each end is partially closed by the Spun End Process to a smaller diameter to accept tube connections for inlet and outlet.

In the case of the accumulator drier illustrated at the top, one end of the tube is formed by spinning. Then, after the screen bag and baffles aré fitted inside, the opposite end is formed.

The low-side drier is produced in the same manner. The final spinning is done after one end has been formed and the vertical flat screens and silica gel have been positioned within the tube.

Both designs obviate use of end closures, thus reducing costs of such extra parts and the resulting assemblies.

A wide variety of end forms can be produced to meet almost any requirements, in both nonferrous and steel.

✓ *The drier at the top is made of copper in standard sizes: 1", 1¼" and 1½" O.D.*

✓ *The lower drier is made of copper in standard sizes: ¾", 1" and 1½" O.D.*

We'll be glad to send you a copy of our brochure, Spun End Tube, describing this process and suggesting ways it can bring you advantages.

*A PATENTED PROCESS RE. 22465

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

WOLVERINE TUBE DIVISION
of CALUMET & HECLA, INC.

Manufacturers of Tubing Exclusively

1419 CENTRAL AVENUE • DETROIT 9, MICHIGAN

Plants in Detroit, Mich. & Decatur, Ala. *Sales offices in Principal Cities*

ESTABLISHED 1916

Other Wolverine Products

CAPILATOR*
—the capillary tube for restriction purposes
COMMERCIAL TUBE
AUTOMOTIVE TUBE
CONDENSER TUBE
COPPER WATER TUBE (K-L-M)
ELECTRIC WELDED STEEL TUBE
FABRICATED TUBULAR PARTS
WOLVERINE TRUFIN*
—the integral finned tube
REFRIGERATION AND AIR CONDITIONING TUBE
(Plain or Tin Plated)
S.P.S. PIPE
SPUN-END TUBE†

*Reg. U.S. Pat. Off.
† A Patented Process RE 22465

NEW THRUSH TANKS

Reduce Draining Time

DRAIN COMPLETELY IN A FEW MINUTES

THE VACUUM BREAKER
NOW IN ALL THRUSH
PRESSURE TANKS

NO EXTRA COST

THE FIRST REAL IMPROVEMENT IN TANK DESIGN IN MANY YEARS! THRUSH ENGINEERING LEADS AGAIN!

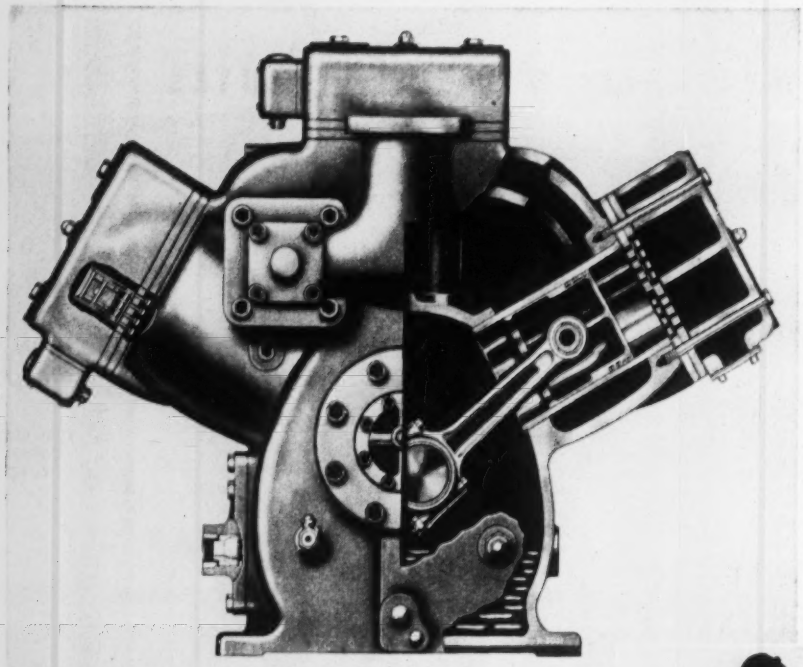
HERE'S AN ADDED convenience feature found only in Thrush Pressure Tanks! It saves your time! . . . saves labor! Reduces service bills! Pleases customers because you can get the system back in operation without delay. No need to drain the whole system. Just close the stop valve, open the drain and unscrew the Vacuum Breaker to allow air to enter the tank. A thirty gallon tank will drain in ten minutes. You get more for your money . . . build greater customer satisfaction, too . . . when you install genuine Thrush equipment. Ask your wholesaler about it or write Dept. E-6.

TO BE SURE IT'S A GENUINE THRUSH PRESSURE TANK . . .
LOOK FOR THE VACUUM BREAKER BEFORE YOU BUY!

H. A. THRUSH & COMPANY

PERU, INDIANA

Optimum-speed Freon compressor has high capacity plus long life!



New Worthington unit combines advantages of low and high speed

CUTAWAY VIEW of the new Worthington "J" compressor—the product of years of engineering research. Maximum capacity, with no loss in operating efficiency, is yours with this lighter-weight, optimum speed machine.

The problem was to design a compressor that would combine the advantages of *low*- and *high*-speed operation. Worthington's answer: the new, *optimum*-speed "J" compressor—a compact, high-capacity machine with the same high operating efficiency and life expectancy as its lower speed predecessors.

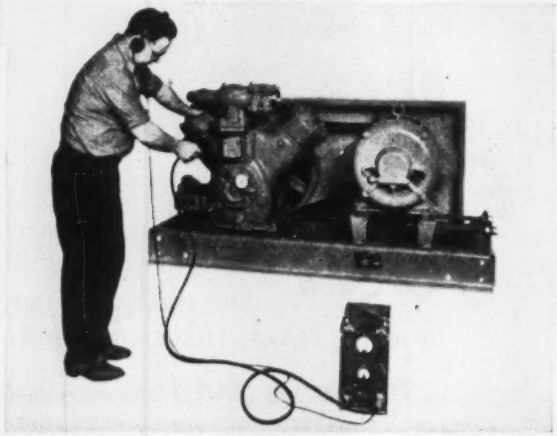
Here are just three of the many advancements in functional design that make the Worthington "J" line of compressors the finest available today.

1. ELECTRIC UNLOADING—a new achievement in variable capacity control. You can start compressor unloaded with a normal torque motor; power consumption is automatically balanced with load requirements. Separate unloader units in cylinder head allow easy maintenance . . . no complicated oil or gas pressure lines to worry about.

2. IMPROVED INTERNAL MANIFOLDING—cool suction gas completely surrounds the cylinder walls, providing longer valve life and increased overall efficiency. All passageways between suction discharge and shutoff valves are cast integrally within the crankcase, eliminating outboard fittings.

3. NEW FORCE-FEED LUBRICATION SYSTEM—full pressure, positive lubrication, regardless of rotation. A new rotary oil pump, driven directly by the crankshaft, eliminates complicated and noisy gear trains. Pump filters oil through a strainer in the crankcase.

Available in sizes of 3 to 150 tons, the new "J" compressors can be supplied with a horizontal shell and tube condenser, or they may be used with the Worthington Evaporative Condenser. Get in touch with your nearest Worthington district office, or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Holyoke, Mass.



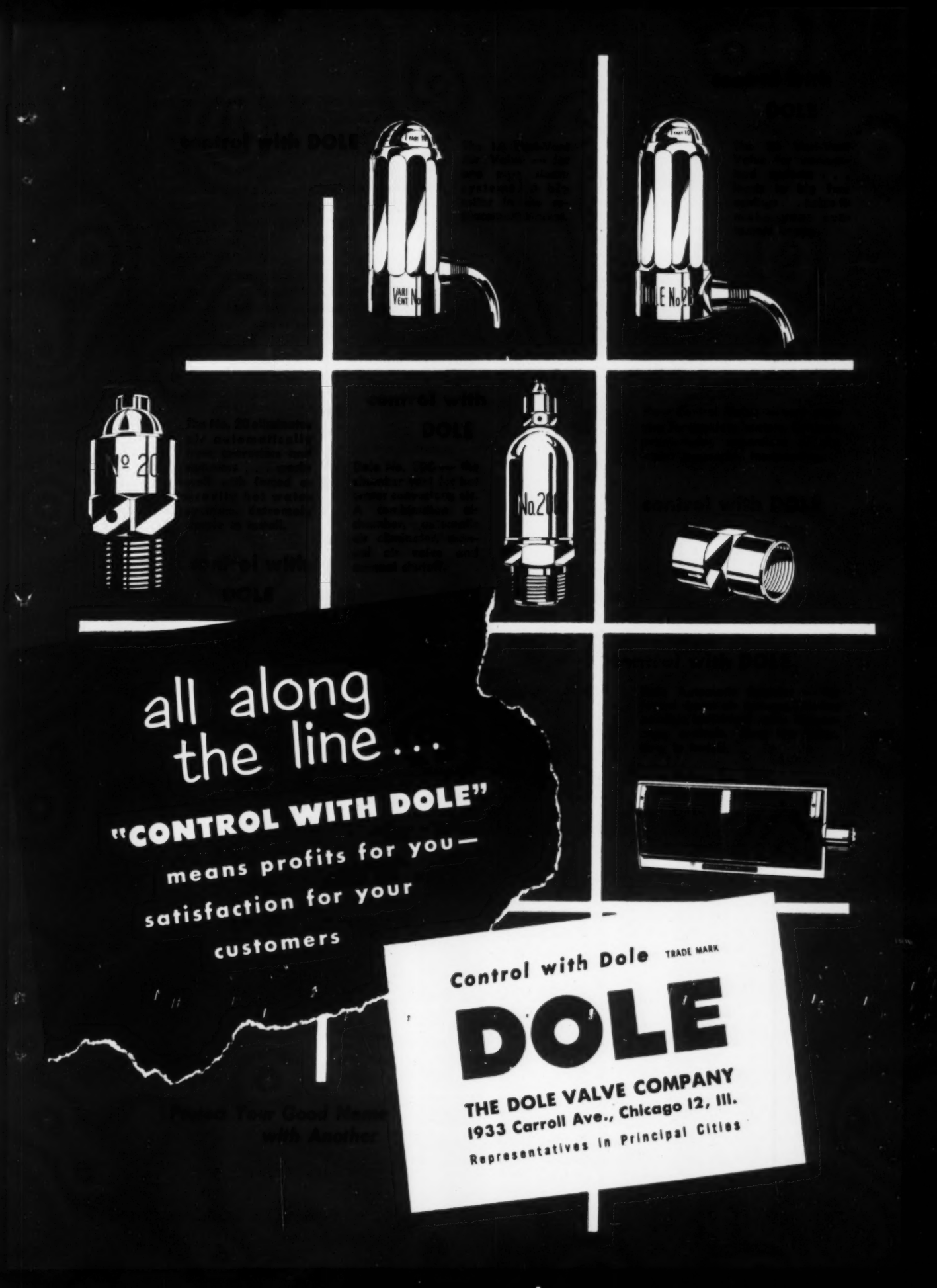
THIS ELECTRONIC LEAK DETECTION TEST is part of the rigid testing that every Worthington compressor goes through before leaving the factory. Pressure tests, underwater tests and vacuum tests make sure that every unit will give long, trouble-free service.

From the most complete line . . . comes the correct recommendation

WORTHINGTON

Air Conditioning and Refrigeration

A-3-3


all along the line...
"CONTROL WITH DOLE"
means profits for you—
satisfaction for your
customers
Control with Dole TRADE MARK
DOLE
THE DOLE VALVE COMPANY
1933 Carroll Ave., Chicago 12, Ill.
Representatives in Principal Cities

Guaranteed TO SHUT TIGHT*

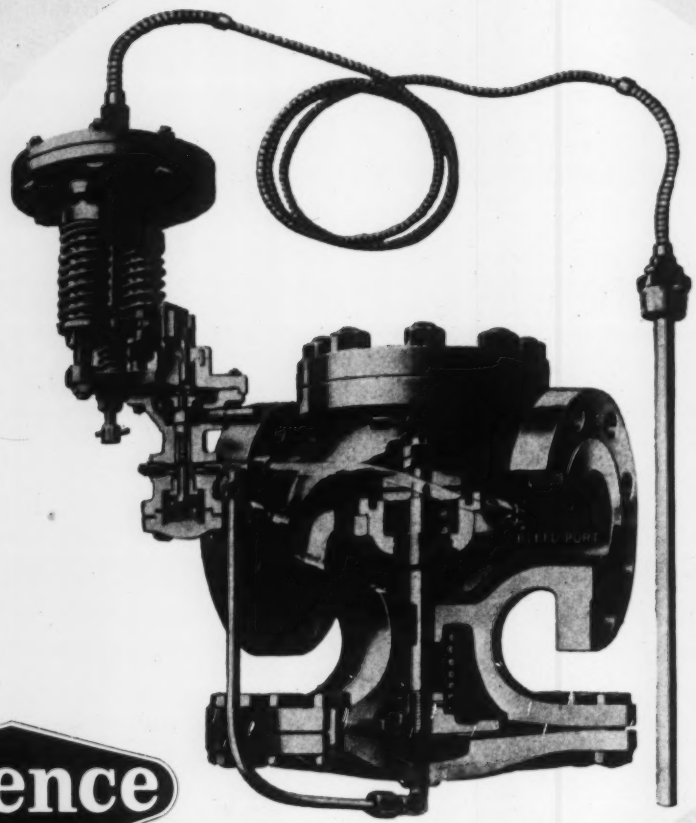
* When equipped with a SECO Metal Seat and Disc on steam service and protected by an approved Strainer, a Spence Regulator is guaranteed to shut tight when the demand for steam ceases.

Expensive steam leaks due to a lack of absolutely tight shutoff are eliminated in Spence Temperature Regulators. Here is why we can make such a guarantee:

First, our temperature regulators are of the single seat design. Seats and discs are made of durable SECO Metal. More than 20 years experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year without requiring expensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.



SPENCE
TYPE ET150
Temperature
Regulator

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

SPANG® CW steel pipe helps protect the quality of *Avon* cosmetics

Owner and General Contractor: **Consolidated Realty Investments, Inc., a Ben J. Massell enterprise, Atlanta, Georgia**
Architect: **H. A. Rawlins, Atlanta, Georgia**
Heating Contractor: **Art Plumbing Company, Atlanta, Georgia**

This new, beautiful combination office-and-warehouse in Atlanta, Georgia, is the southeastern distribution point for top quality cosmetics, perfumes and men's fine toiletries produced by Avon Products, Inc. Modern in every respect, Avon's new building was designed for comfort, efficiency and attractiveness.

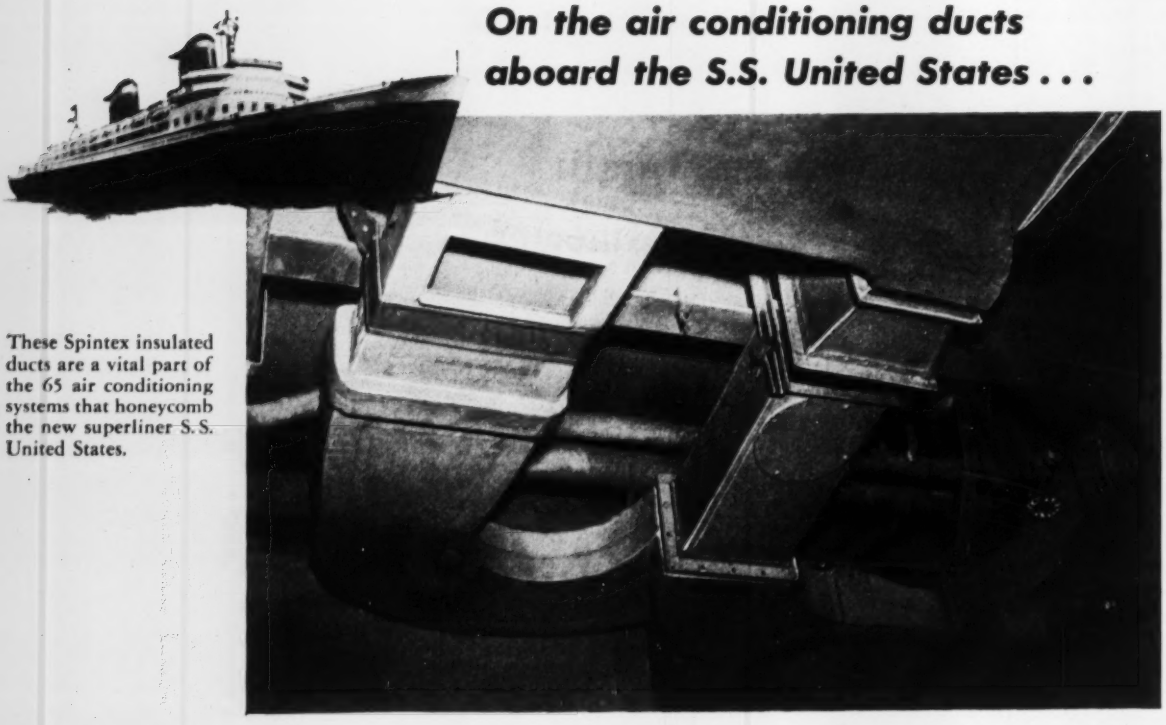
Cosmetic products are perishable and call for great care in storage. One of the requirements of the new building was a heating system that would provide maximum heat distribution to protect the many types of products in the warehouse from atmospheric damage and low temperatures. Spang CW Steel Pipe was installed to provide lines for the heating system throughout the 62,400-sq. ft. building.

Like the products it serves, Spang CW Steel Pipe is a quality product . . . made on the most modern machines from high-grade skelp, controlled and inspected constantly throughout production and thoroughly tested before shipment. This care in manufacture assures customers of a reliable and high-standard pipe, easy to cut, thread and bend . . . for use in steam, water, gas and air lines and many specialized applications. That's why owners, architects, engineers and contractors who want a quality product specify Spang CW.

Next time you order pipe, tell your local Spang Distributor you want Spang quality-controlled CW Pipe. You'll be glad you did.

SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Office: Pittsburgh 30, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis.

On the air conditioning ducts aboard the S.S. United States . . .



These Spintex insulated ducts are a vital part of the 65 air conditioning systems that honeycomb the new superliner S.S. United States.

NEW J-M *Spintex* INSULATION CONSERVES FUEL AND POWER

MILES OF DUCTS . . . a vital part of the 65 air conditioning systems that honeycomb the S. S. United States . . . are insulated with Johns-Manville Spintex. This insulation was selected because it makes possible maximum passenger comfort at minimum operating cost.

Low thermal conductivity . . . plus resistance to moisture, fire, rot and mold growth . . . make Spintex the most effective insulation for guarding against heat transfer and moisture accumulation.

Spintex in flexible and semi-rigid types, plus rigid Rock Cork* and Zerolite*, form a team of Johns-Manville insulations for air conditioning ducts that meet every industrial requirement. Basically mineral products, each insulation has its particular characteristics that make it specially suitable for a specific air conditioning service. All three have the low heat transfer properties needed for high insulating efficiency. Properly installed, these insulations for air conditioning ducts will perform their function effectively for the entire life of the equipment on which they are applied.

Since proper application is so essential to the peak performance of any insulation, Johns-Manville offers industry the services of experienced installation contractors who have made a career of solving complex insulation problems.

J-M Insulation Engineers and J-M Insulation Contractors are conveniently located. They stand ready to combine their talents and give you an insulation job that will pay off your initial investment with maximum fuel savings.

Why not let us send you a free copy of Brochure IN-135A which gives all the facts about Johns-Manville Insulations for Air Conditioning Ducts? Write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

*Reg. U. S. Pat. Off.

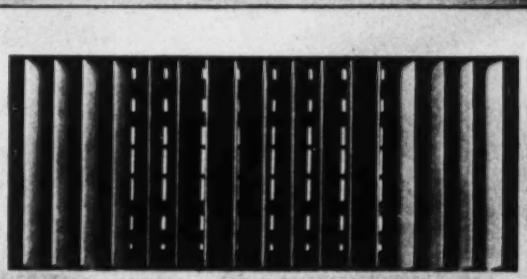
Applying Johns-Manville Spintex insulation on one of the ducts aboard the S. S. United States during construction at the Newport News Shipbuilding and Dry Dock Company. Johns-Manville Insulation Contractors throughout the country know Spintex and other J-M insulations as *quality* products, and take pride in applying them properly for peak performance.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION

NEW ... with OPPOSED BLADE DAMPERS

SERIES 277



4-WAY Air Foil REGISTER

Series 277 combines 4-way directional grille with opposed blade damper. This provides both maximum directional control and positive volume control. Opposed blade dampers supply uniform distribution of air over entire grille face.

LATEST AND FINEST PRODUCT OF TITUS ENGINEERING. It stands out... by any comparison ... in its *beauty, rugged design... superior diffusion performance.*

FRAMES ... Heavy gauge cold-rolled steel. One piece.

BORDER ... 1¼" beveled edge.

LOUVERS ... Streamlined. Smooth as glass. Solid section.

LOUVER DEPTH ... ¾". Assures positive air deflection.

SCREW HOLES ... Countersunk for No. 6 screws. Spaced ½" on center from outer edge of border.

FINISH ... Gray lacquer primer as standard. Other finishes available at slight extra cost.

GASKET ... ¼" sponge rubber.

ADJUSTMENT ... Individual louver adjustment for front and center set of louvers. Opposed acting damper blades in rear are key operated.

• BRAND NEW 1953 CATALOG. Simplifies specifying. Provides all engineering data you need.

REQUEST YOUR FREE COPY NOW, including all specification and engineering data plus facts on construction, performance and selection of outlets.

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

- ☐ Air conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Perforated metal and ornamental grilles
- ☐ Door ventilators
- ☐ Special made-to-order grilles

TITUS MANUFACTURING CORP., WATERLOO, IOWA

- ☐ RUSH information on Series 277.
- ☐ Send complete New 1953 catalog.
- ☐ Send literature on above checked items.

NAME_____

ADDRESS_____

CITY_____ STATE_____

How Honeywell Customized Temperature Control helps promote

a $40 million annual business!

Specially designed systems help make new Chicago shopping center one of nation's finest

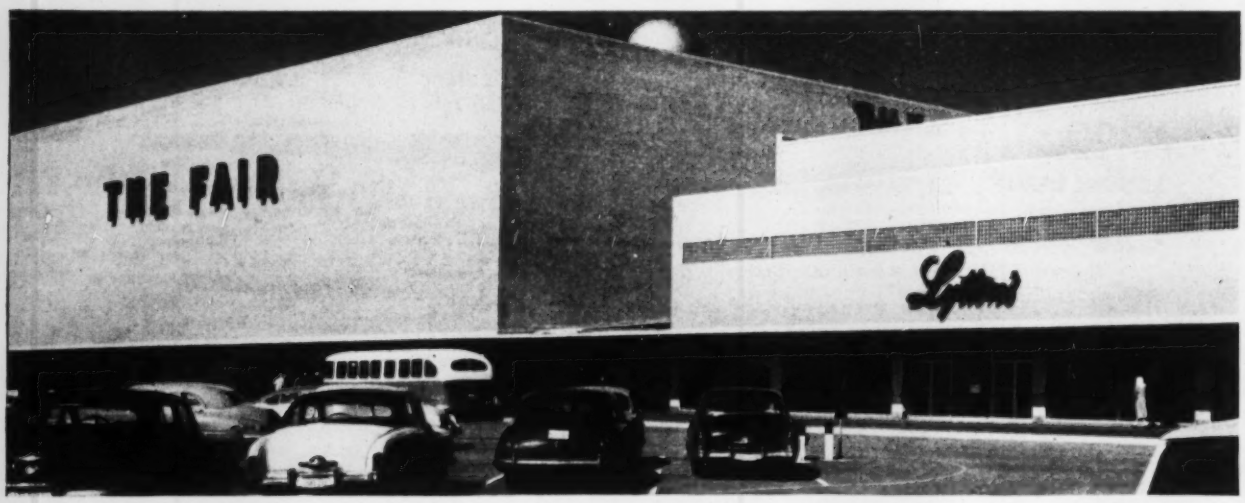
Evergreen Plaza is Chicago's newest (opened only last August) and biggest (6,100,000 cubic feet) shopping center. Projection of current business figures indicate that by the time the Plaza's first anniversary rolls around, turnover will have been $40 million.

Many factors account for the center's booming business. It's within easy reach of 500,000 shoppers. Nearly every type of retail outlet is represented. Parking space is generous, will accommodate 2,200 cars. Design is functional—and pleasant.

And most of the stores are equipped with Honeywell Customized Temperature Control—to help provide ideal customer comfort, good employee morale and economical use of fuel.

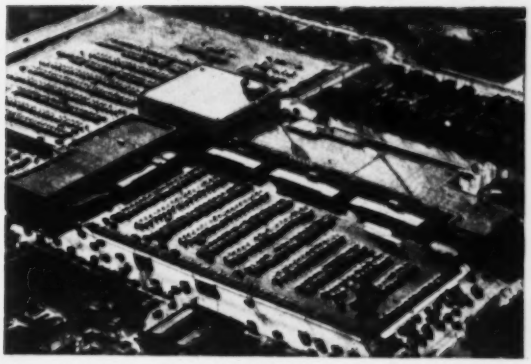
Individual stores chose the controls that best fit their needs—and budget. A wide variety of controls was available to choose from because Honeywell manufactures all three types of temperature controls—pneumatic, electric and electronic. And *only* Honeywell makes all three.

Large or small floor space, eastern or northern or southern exposure, occupancy by a small, select clientele or department-store-size crowds—all these varying factors were taken into account at Evergreen Plaza by Honeywell Customized Temperature Control.



Most of the smaller shops above have individual Honeywell thermostats. By adjusting these individual thermostats, store managers can provide the temperature employees and customers find most comfortable. Smokestack identifies project's central steam plant—controlled for most economical operation by Honeywell boiler room controls.

One or more thermostats on each floor of the larger stores below provides zoned comfort. Thus, in winter the first floor thermostat calls for heat required to compensate for cold air entering doorways, keeps first floor at same *comfort* level as other floors. Thermostats on other floors compensate for different occupancy, exposure and use problems found there.



Evergreen Plaza center was created by Arthur Rubloff, Arthur Rubloff & Co., Chicago; Howard T. Fisher & Associates, Inc., Architects & Engineers; Holabird & Root & Burgee, Architect-Engineer; George A. Fuller Company, Builders.

For comfortable, even temperature in new or existing buildings—of any size—use Honeywell Customized Temperature Control

Whether it's a shopping center, apartment, church, school, office, factory, hospital, garage—or any size building—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

Once equipped with Honeywell Customized Temperature Control, they'll have an ideal indoor "climate"—and save fuel besides.

And with a complete line of pneumatic, electric and electronic controls to choose from, Honeywell Customized Temperature Control offers you the greatest flexibility in design. Then, too, when it comes to performance, Honeywell-built controls assure years of trouble-free operation. And they're backed by the finest service organization in the controls industry.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. There are 104 across the nation. Or mail the coupon today.

Willard A. Brown, Rubloff's project managing director, says: "We have a great many different temperature control problems here at Evergreen Plaza. Honeywell handles them all extremely well. Fuel consumption is low, too."

MINNEAPOLIS
Honeywell

First in Controls

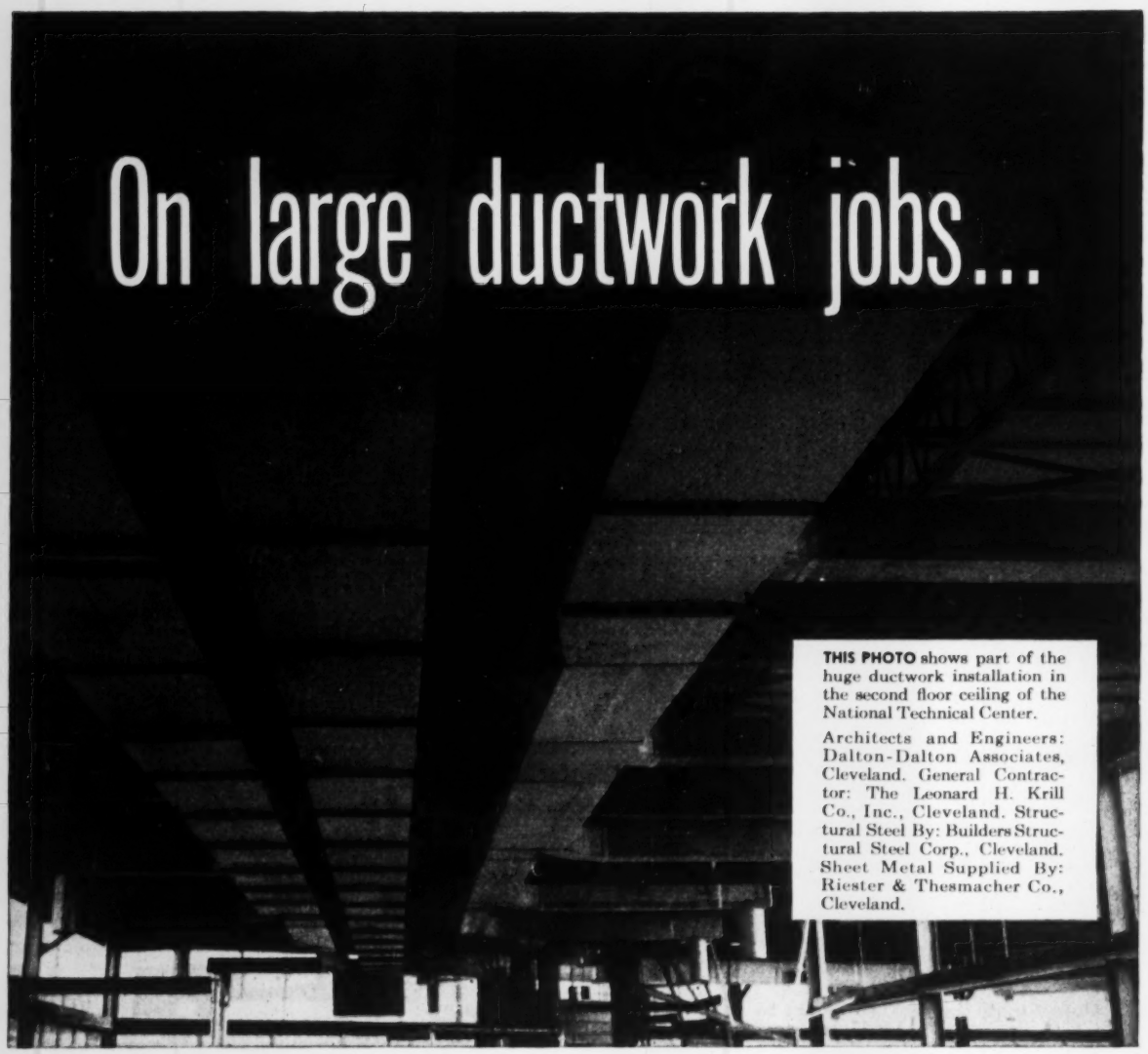
MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HA-6-122, Minneapolis 8, Minnesota
Gentlemen: I'm interested in learning more about Honeywell Customized Temperature Control.

Name .....

Firm Name .....

Address .....

City ..... *Zone* ..... *State* .....


On large ductwork jobs...
THIS PHOTO shows part of the huge ductwork installation in the second floor ceiling of the National Technical Center.
Architects and Engineers: Dalton-Dalton Associates, Cleveland. General Contractor: The Leonard H. Krill Co., Inc., Cleveland. Structural Steel By: Builders Structural Steel Corp., Cleveland. Sheet Metal Supplied By: Riester & Thesmacher Co., Cleveland.

U·S·S Galvanized Steel Sheets... for faster, better workmanship

THIS large ductwork installation for the heating system of the new National Malleable and Steel Castings Company's Technical Center in Cleveland, Ohio, is typical of the many large jobs that are entrusted to U·S·S Galvanized Steel Sheets. For heating and metal-working men know that for good, time-saving workmanship—neat, long-wearing finished jobs—and satisfied customers, there's no better sheet to use than U·S·S Galvanized.

U·S·S Galvanized Steel Sheets fabricate easily, even under difficult working conditions. They are uniform in softness, flatness and surface . . . can be rolled, bent, cut, stamped or soldered. The heavy, corrosion-resisting zinc coating won't crack or flake during handling.

Your customers are familiar with U·S·S Steel Sheets—and the U·S·S Label. They know this label stands for dependable quality in steel of every kind. To assure continuing good jobs and customer approval, be sure to specify U·S·S Galvanized Steel Sheets by name when you place an order.

UNITED STATES STEEL CORPORATION, PITTSBURGH · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S GALVANIZED STEEL SHEETS

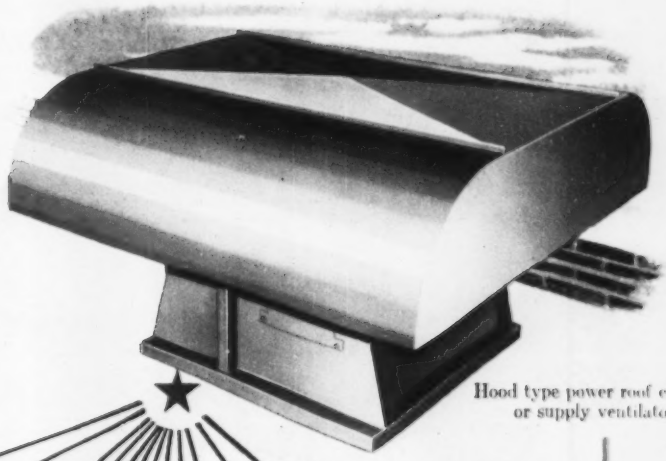
USS

UNITED STATES STEEL

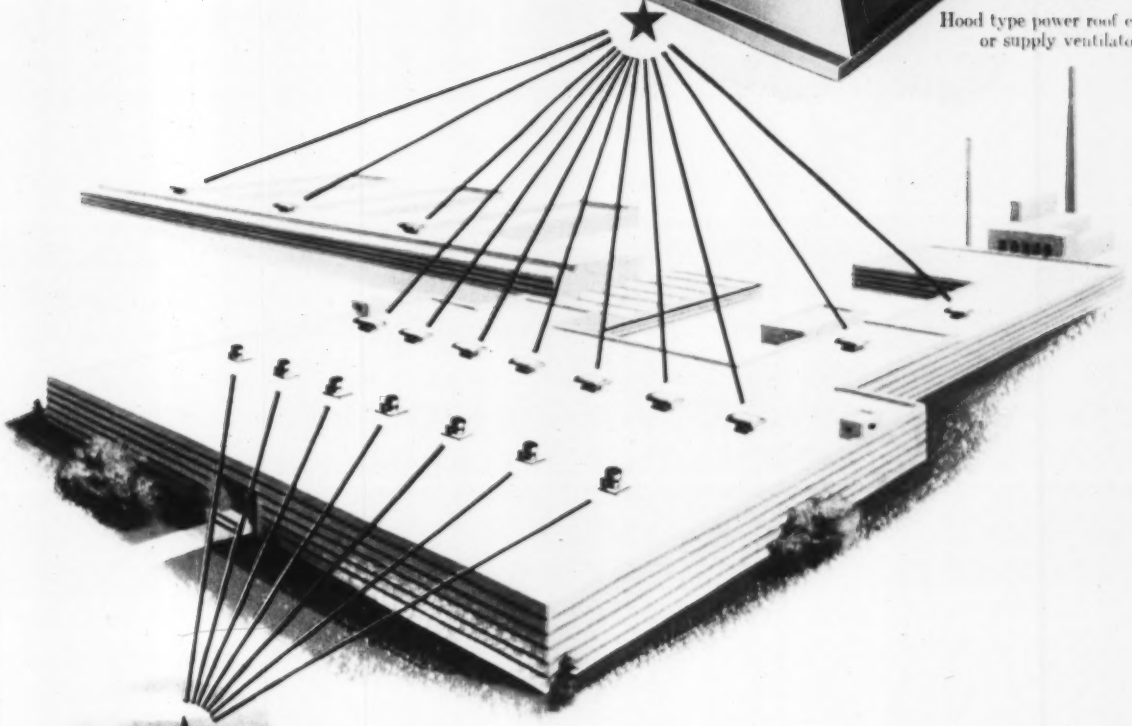
AMERICAN BLOWER

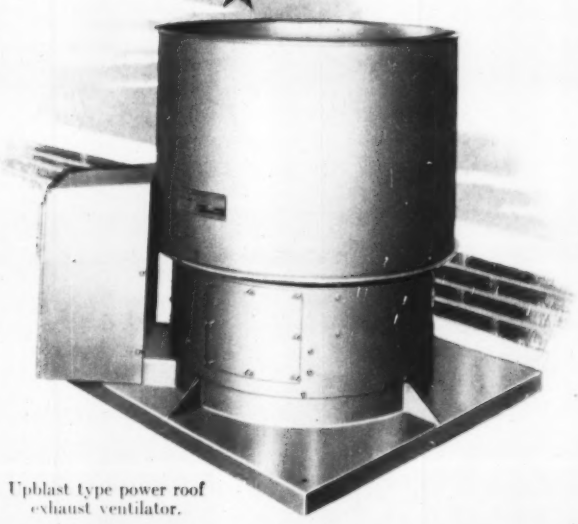
Power

Roof Ventilators



Hood type power roof exhaust or supply ventilator





Upblast type power roof exhaust ventilator.

American Blower *power* roof ventilators give you the advantages of balanced ventilation, without the uncertainties of gravity units or the expense of a central system.

They're quickly and easily installed on all types of roofs. No extensive duct work is required; no valuable floor space is wasted. Use single units for spot ventilation; several units for large area coverage. American Blower power roof ventilators, supply or exhaust, are available in a wide range of capacities. They are designed to furnish balanced ventilation to industrial plants and commercial buildings.

Ask our nearest branch office for data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS EXCHANGERS

The New Louisiana Purchase

EVERY day America crosses a frontier—the frontier of a new market. It is the market created by an ever growing population. Since Pearl Harbor, our population has increased 23½ millions—more than all the people now living in the region west of the Mississippi once called the Louisiana purchase, that vast billion-acre area which provided us with geographical frontiers for a hundred years.

During 1952, 8,500 babies were born daily, increasing our population by nearly 3,000,000 people. New families and bigger families need more and bigger houses, more food, clothing, cars, roads, hospitals, churches, schools. Their needs call for continuing and increasing production from farms and factories.

There are those among us who say a decline in government spending will bring depression. But where is there room for depression when we add the population of another Minnesota or an Iowa to our nation each year—when the need for goods and services increases steadily? In fact, only by tapering off our vast programs of government spending can industry and business hope to provide sufficient goods to maintain our present standard of living and satisfy the demands of our ever growing population.

Let no one tell you America has crossed its last frontier.

QUALITY YOUNGSTOWN SERVICE

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York
MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.

Send for your new EQUATEMP® FOLDER
ONE VALVE DOES TWO JOBS— Shuts off. Controls Flow
EQUA TEMP
OFFERS EFFECTIVE FLOW CONTROL PLUS COMPLETE SHUT-OFF
In One Low-Cost Balancing Valve For Hot Water Heating And Air Conditioning
Floor
Ceiling
Baseboard
Panel
Convector
Unit Air Conditioners
Unit Heaters
NO. 48 BY-PASS VALVE
Ideal companion for Equatemp on any type of Heating and Air Conditioning Unit where Manual control is desired. Also can be used separately from Equatemp.
(Details on back cover)
OHIO BRASS COMPANY • MANSFIELD, OHIO

To Save Fittings, Save Time, Save Space

When Equatemp® was introduced three years ago, it was intended primarily for use in hot water radiant heating systems. Radiant heating has proved to be the most important application. But ingenious architects and heating and ventilating engineers soon found additional uses for this versatile valve that both balances and shuts off. It saves installation time, reduces the number of fittings required, and can be installed in a small space. It has become popular on room-type units that can be used for either heating or cooling.

Ohio Brass engineers also have developed the new No. 48 Line By-Pass Valve. It can be used with Equatemp on room-type units. Or it can be used separately. The by-pass allows enough flow in winter to prevent freezing when the valve is closed. In the summer the by-pass can be closed to avoid danger of excess condensation.

The new Equatemp folder covers the additional applications for Equatemp and describes the new No. 48 valve. To get your free copy, just mail in the coupon below.

Ohio Brass

MANSFIELD • OHIO

BRONZE GLOBES • GATES • ANGLES
FOR INDUSTRIAL, DOMESTIC SERVICE

4376-V

Ohio Brass Company
Mansfield, Ohio

Please send me the new Equatemp folder, 1271-V.

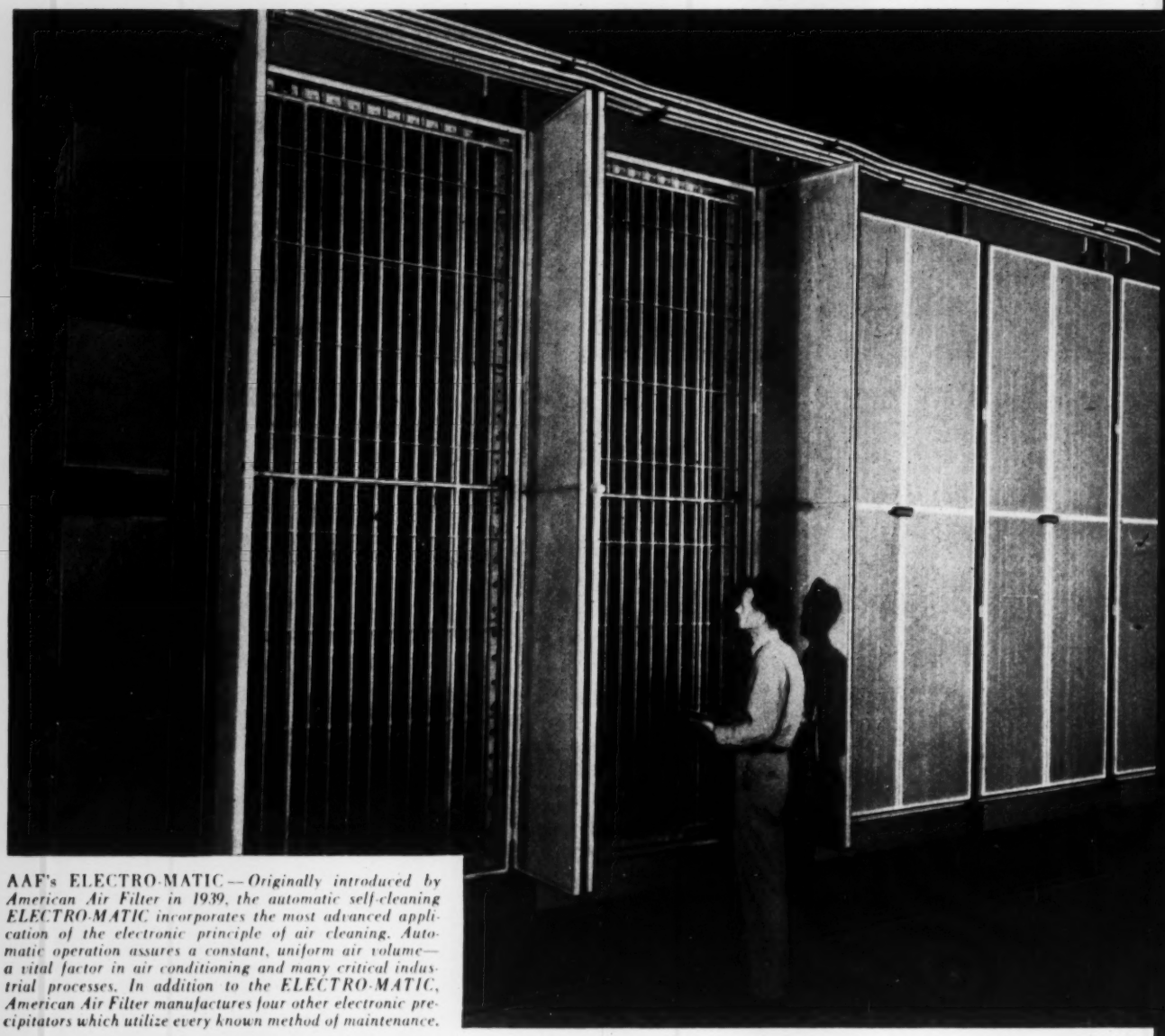
Name .....

Company .....

Street .....

City ..... State .....

Why five types of

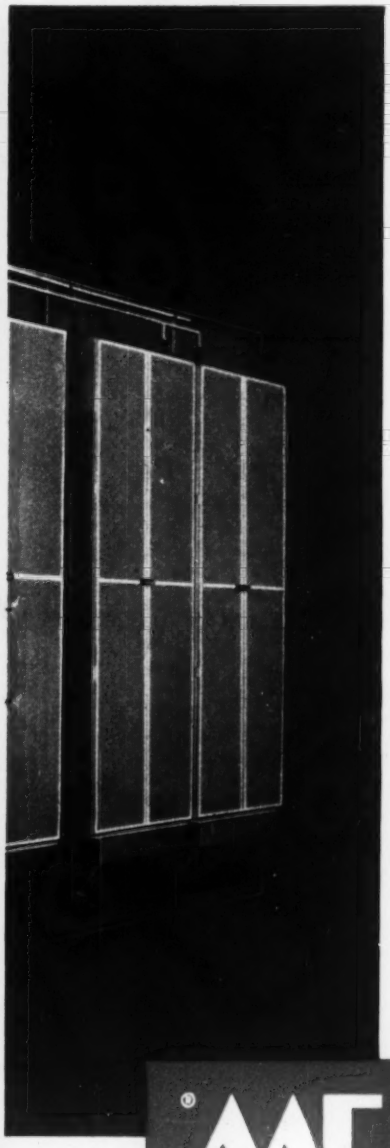


AAF's ELECTRO-MATIC — *Originally introduced by American Air Filter in 1939, the automatic self-cleaning ELECTRO-MATIC incorporates the most advanced application of the electronic principle of air cleaning. Automatic operation assures a constant, uniform air volume— a vital factor in air conditioning and many critical industrial processes. In addition to the ELECTRO-MATIC, American Air Filter manufactures four other electronic precipitators which utilize every known method of maintenance.*

a single source for all air cleaning equipment . . . . . .

ELECTRO-CELL | ELECTRO-PL | ELECTRO-MIST | ELECTRO-KLEAN | AUTO-AIRMAT | AIRMAT PL-24 (with felt) | AIRMAT PL-24

electronic air cleaners?



AAF's five distinct types of electronic precipitators have highly individual characteristics . . . for a reason! As part of AAF's complete line of air cleaning equipment, they were developed to meet complex and distinctly different air cleaning requirements for fine particle size in both commercial and industrial application. As a result, the engineer is given the opportunity to *select* from a wide range of performance characteristics, rather than to be restricted to one type of electronic precipitator and try to make it fit the job.

AAF's group of five electronic precipitators offer these selective features:

- Different Efficiency Ratios
- Several Methods of Maintenance
- Variety of Space Requirements
- Wide range of sizes and air volumes
- Practical and realistic range of initial costs

In addition to manufacturing the only complete line of air cleaning products, AAF's engineering staff is recognized as the leading authority in this field. The specialized knowledge of these men can save you time, effort and expense. If you have a dust problem, let us help you solve it.

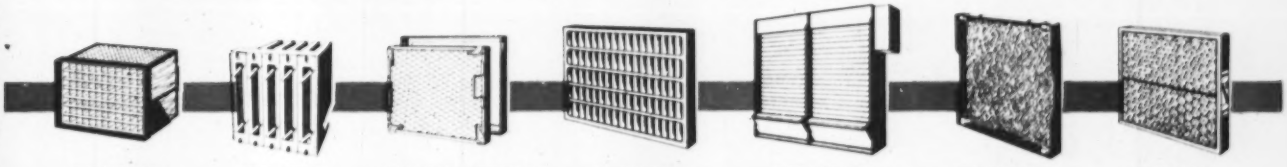
Complete engineering data on all AAF equipment is available. Contact your nearest AAF representative, or write American Air Filter Company, Inc., 373 Central Avenue, Louisville 8, Ky.

® AAF

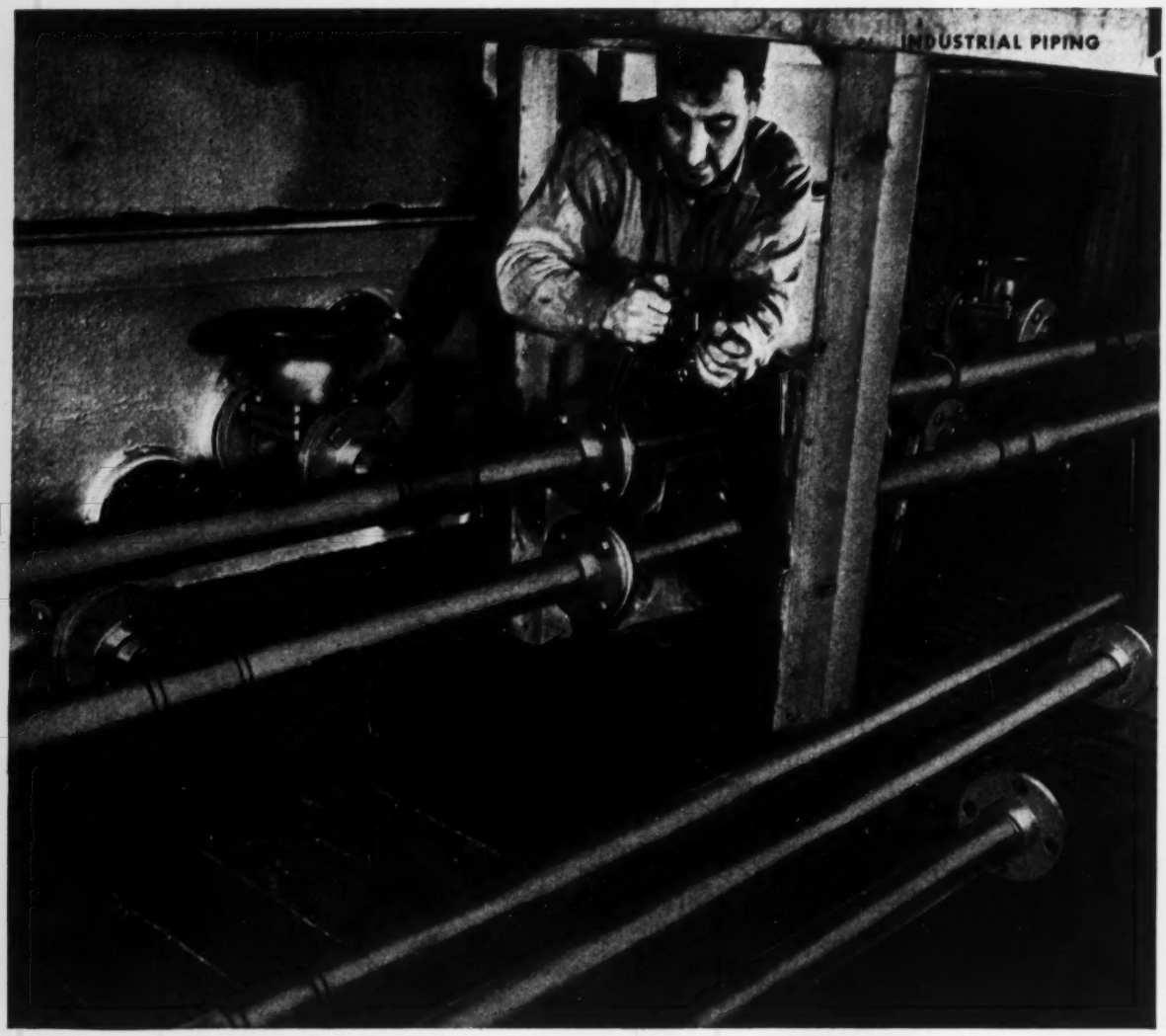
American Air Filter
COMPANY, INC.

373 Central Avenue, Louisville 8, Ky.

American Air Filter of Canada, Ltd., Montreal, P. Q.
Pacific Division Office, San Francisco, California

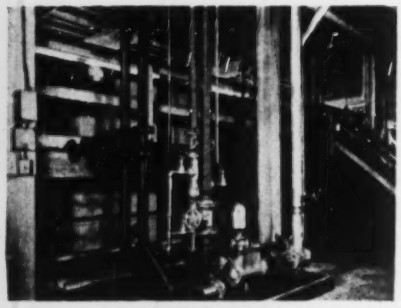


DEEP-PAK | DEEP BED | M/W-H/V UNITS | DRIFILTER | MULTI-DUTY | RENU-GLAS | AMER-GLAS



PROCESS TANKS at Chas. Pfizer & Co., Inc. use copper gravity feed lines. The S.P.S. threadless bronze fittings are silver-alloy brazed to the tubes. Joint strength is high; yet piping can be easily dismantled.

Can your process piping profit from AnacondA Copper Tubes?



THESE 2½-IN. COPPER TUBES resist corrosion from crude press liquors used to produce citric acid in plant of Chas. Pfizer & Co., Inc.

In the Groton, Conn. plant of Chas. Pfizer & Co., Inc., chemical and pharmaceutical manufacturers, copper tubes are widely used for process piping. In this, as in many other industrial piping applications, ANACONDA Copper Tubes and ANACONDA 85 Red Brass Pipe offer many economic and process advantages.

Foremost are copper's corrosion resistance and immunity to rust. This means increased piping life, lower maintenance, unobstructed flow and easy dismantling for reuse later. When copper tubes and solder type fittings are used, time and labor saved can make the installed cost of copper competitive with ferrous piping.

There's a story in ANACONDA Copper Tubes for your industrial piping. Write for Publication C-24 to *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.* 5335

for copper piping call an

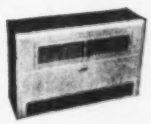
ANACONDA®

Distributor

34

years experience stands behind these products . . . it's all yours when you specify *Acme* air conditioning and refrigeration equipment

Since 1919 Acme has been building units to serve air conditioning and refrigeration fields. During that time they have experimented with thousands of models and installations. On-the-job and in-the-field service has always been the criterion for any design changes Acme makes. Today, Acme has this complete line of commercial refrigeration and air conditioning equipment — the end result of 34 years experience. You gain all this experience for yourself and your customer by the simple act of specifying Acme on your next installation.



FLOW-COLD* Remote Room Conditioner

Designed for the modern recirculated hot or cold water air conditioning systems. Whisper quiet operation with variable air recirculation permits efficient individual zone control.

HI-PEAK* Water Cooler

Seven standard sizes providing large storage capacity and all non-ferrous surfaces in contact with the water.

ACME JCT Cooling Towers

Available for use where compactness counts. An all metal tower completely galvanized for long life. Capacities from 3 to 10 tons.

ACME Liquid Receivers

More than 70 standard sizes for Freon, Ammonia, or other refrigerants.

ACME Oil Separators

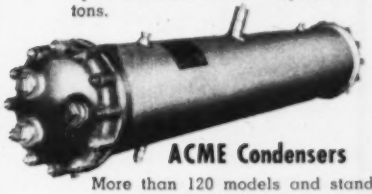
A complete line of Freon or Ammonia Separators for 1/4 to 100 ton systems.

ACME Heat Exchangers

A complete line of compact, efficient Freon Suction and liquid line heat exchangers. Capacities from 3 to 200 tons.

DRY-EX* Water Chiller

More than 700 combinations from which to choose, assuring you of the most efficient chiller operation obtainable. Capacities from 5 to 260 tons.

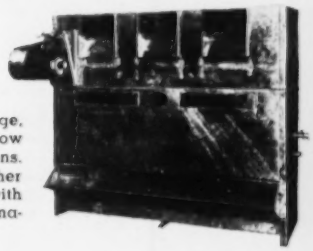


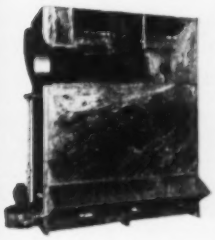
ACME Condensers

More than 120 models and standard sizes of Freon and Ammonia shell and tube and shell and coil types. Capacities from 5 to 700 tons.

BLO-COLD* Industrial Unit Cooler

For vegetable storage, packing plants and low temperature installations. 5 distinct series for either Freon or Ammonia with more than 260 combinations.



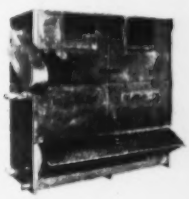


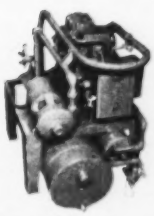
ACME Evaporative Condensers

For Freon or Ammonia. More than 30 models from which to choose. Your choice of copper or steel coils. Completely hot-dipped galvanized after fabrication. Capacities from 4 to 130 tons.

ACT Cooling Tower

All metal, hot dipped galvanized induced draft cooling tower. Available with exclusive Acme snug fitting pump for all 16 models. Capacities from 8 to 60 tons.





FLOW-COLD* Packaged Liquid Chiller

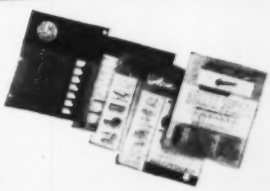
A pre-tested liquid chilling unit shipped ready for installation. Matched Acme components for systems of 2 to 15 tons.

Addition of the Acme change over valve results in the Flow-Temp heat pump. A complete heating and cooling system in one compact package.

*Trade Mark

SERVING THE REFRIGERATION AND AIR CONDITIONING INDUSTRY SINCE 1919

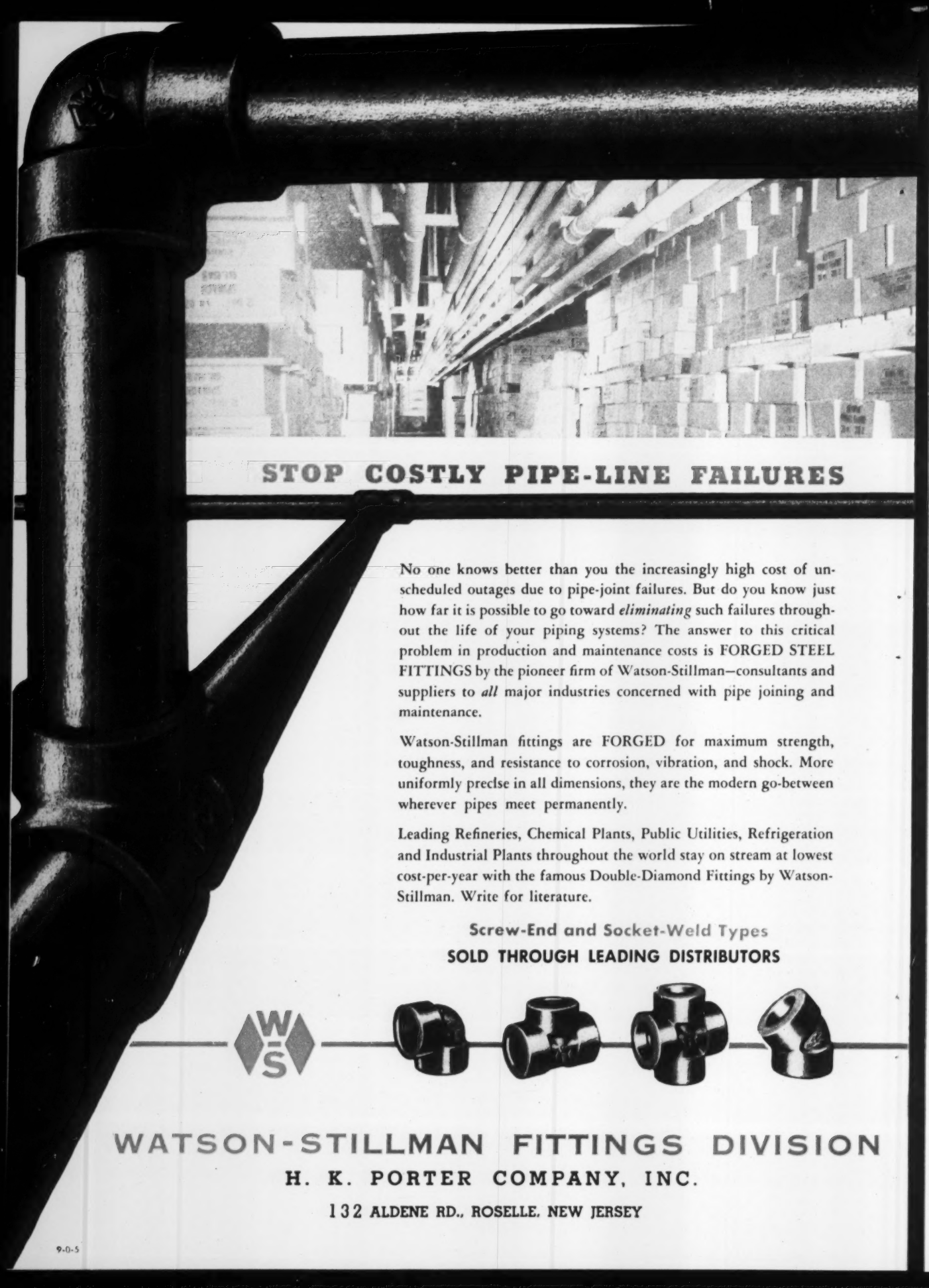
* *Write for catalogs on any of the products listed.*



ACME INDUSTRIES, INC.

JACKSON, MICHIGAN

ACME



STOP COSTLY PIPE-LINE FAILURES

No one knows better than you the increasingly high cost of unscheduled outages due to pipe-joint failures. But do you know just how far it is possible to go toward *eliminating* such failures throughout the life of your piping systems? The answer to this critical problem in production and maintenance costs is FORGED STEEL FITTINGS by the pioneer firm of Watson-Stillman—consultants and suppliers to *all* major industries concerned with pipe joining and maintenance.

Watson-Stillman fittings are FORGED for maximum strength, toughness, and resistance to corrosion, vibration, and shock. More uniformly precise in all dimensions, they are the modern go-between wherever pipes meet permanently.

Leading Refineries, Chemical Plants, Public Utilities, Refrigeration and Industrial Plants throughout the world stay on stream at lowest cost-per-year with the famous Double-Diamond Fittings by Watson-Stillman. Write for literature.

Screw-End and Socket-Weld Types

SOLD THROUGH LEADING DISTRIBUTORS

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

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Mr. Piping Contractor:

HERE'S THE EASIER, FASTER, LOW-COST WAY TO

INSTALL YOUR PIPES THEN INSULATE THEM!

WITH

"Z-crete®"

THE MODERN MONOLITHIC INSULATION FOR UNDERGROUND HEATED PIPING

Here's the easy, fast, economical way to install —*then insulate*— underground heated piping . . .

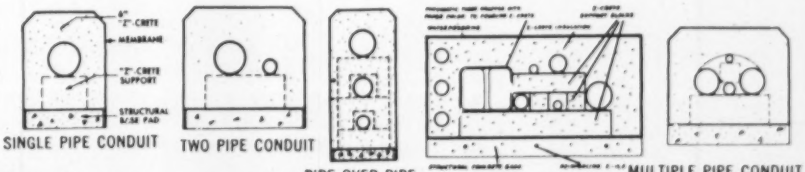
EASIER because the structural concrete base pad provides better working conditions, and because pipes can be welded on or below grade, and placed with no special care or handling.

FASTER because Z-Crete is entirely a field fabrication. Job changes can be effected during job progress. Any size, number, or arrangement of pipes can be placed in one conduit. No pre-formed sections required.

LOW-COST because Z-Crete is poured directly around pipes *after* they are welded and tested, leaving no joints or voids to leak heat. Greater thicknesses of insulation may be provided at less cost with the Z-Crete system.

Z-Crete is a patented process installed by experienced licensed applicators. There is one nearby, ready to serve you. Why not inquire today! For additional Z-Crete specifications, mail coupon below for FREE booklet with complete details.

FOR ANY HEATED UNDERGROUND SYSTEM



"Z-crete®"

DIVISION

ZONOLITE COMPANY

135 South LaSalle St., Chicago 3, Illinois

Z-Crete is furnished and installed only by licensed applicators of Zonolite Company under U. S. Patent No. 2355966— Canadian Patent No. 439356.

WRITE FOR FREE BOOKLET

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Please rush FREE Z-Crete Booklet with full details and specifications about this easier, faster insulation for underground heated piping.

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Company.....

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City.....Zone.....State.....

WE HAVE A PLAN THAT HELPS YOU—

Peerless offers you a big extra. As part of an extensive sales plan, the Peerless engineering staff is available to anyone wishing more detailed fan and blower information for any job, small, medium or large. A collect call to Peerless will put this engineering staff to work on your problem. If necessary, Peerless will fly a man to your doorstep for consultation.

Besides this direct-to-you engineering service, Peerless has a national network of salesmen, wholesalers and contractors. This sales force features the Peerless complete line of competitively priced fans and blowers, equipped with job-matched Peerless-built motors. Thus, the fans and blowers are guaranteed with undivided responsibility.

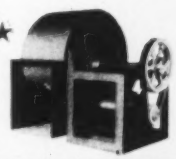
Why not take advantage of this sales plan, geared to fit your needs? Simply call, write or wire us collect regarding your present jobs, or for a catalog of the complete line with specifications, dimensions and drawings.

PENTHOUSES

Economical in cost, installation and operation. Can be matched with any Peerless Electric fan. For factories, laundries, stores, clubs and auditoriums.

BLOWER-FILTER PACKAGE UNIT

A complete unit, including filters, ready for installation. A heavy-gauge steel unit, modern in design, with baked enamel finish. Has balanced wheels, large access door and direct-belt drive. Operates quietly and is easily serviced.



BELT DRIVE UTILITY BLOWERS

A completely assembled blower with an adjustable motor pulley for various speeds. Housings can be tilted when exhaust angles are required.

BELT DRIVE EXHAUST FANS

For installation in ducts where low static pressure resistance is encountered. Built for continuous performance with totally enclosed ball-bearing motors. Moves dusty or humid air.

INDUSTRIAL EXHAUST FANS

A vital part of the full Peerless line! For warehouses, foundries, storerooms, etc. Continuous duty fan with totally enclosed ball-bearing motors. Can be horizontally or vertically mounted. Stock for more industrial sales!

FURNACE BLOWERS

A ruggedly-constructed unit that cuts installation time. Positive belt drive with job-matched motor gives quiet, smooth performance. Ideal for quick installations and added profits.

PRESSURE BLOWERS

High pressure air moving or cooling problems are quickly solved with the Peerless Pressure Blowers. Blades are dynamically balanced and self-cleaning. Heavy-gauge steel base and housing.

DIRECT DRIVE UTILITY BLOWERS

For boiler rooms, restaurants, washrooms, etc. Housings constructed of 16-gauge steel. Peerless job-matched motors are available for all types of electrical currents.

SMOOTHEST PERFORMERS ON THE MARKET

Peerless Electric

FAN AND BLOWER DIVISION

THE PEERLESS ELECTRIC COMPANY

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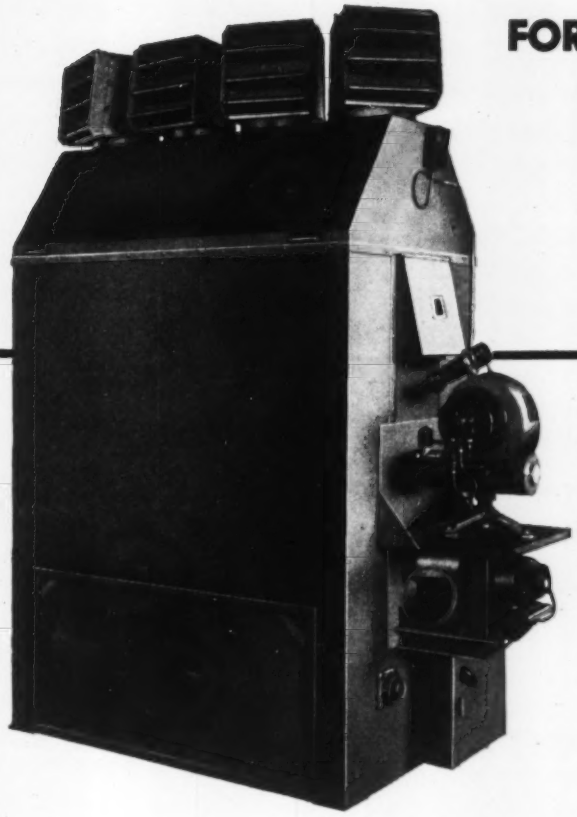


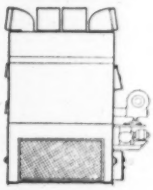
FOR Popular Parts

Because the Olson Heaters stand for high quality, right down the line, all parts and accessories are of the best name and quality known to heating engineers. A heater can be no better than its accessories.

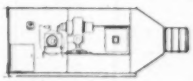
Look over the Olson, consider the fact that all the parts are standard products of nationally known manufacturers. What's even more important, replacements are easily procured from heating suppliers, everywhere. This feature really pays dividends during the life of the heater.

And consider that Olson Heaters are engineered for rugged durability to give long life plus smooth operation.

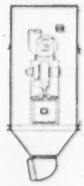
There is an OLSON heater to meet any heating requirement for space heating and special adaptions.



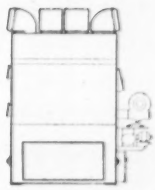
FLOOR MODEL



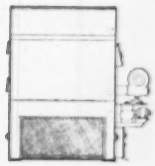
HORIZONTAL MODEL



INVERTED MODEL



RETURN AIR DUCT



DUCT TOP

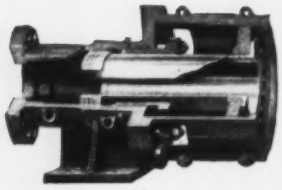
ARTHUR A. OLSON & COMPANY
BROAD ST. CANFIELD, OHIO

Mail this coupon for further information about sizes and ranges, detailed operation.

Representatives in principal cities.

ARTHUR A. OLSON & COMPANY
CANFIELD, OHIO
Please send me Olson Direct Fired Heater Catalog.

Name.....
Firm.....
Address.....
City.....State.....



ONLY ADSCO SLIP JOINTS CAN BE UNPACKED AND REPACKED AT FULL OPERATING PRESSURE

• ADSCO is the only manufacturer offering a slip-type expansion joint whose packing can be removed and replaced at full line pressure. In some makes of joints, new packing can be added, but when this packing becomes old, hard, and useless, it can not be removed without first shutting off the pressure . . . Not so with ADSCO's Piston-Ring Expansion Joints, which can be *unpacked* and repacked without the slightest interruption of service. Job is done under normal working conditions . . . but only if ADSCO Piston-Ring Joints are used.

• ADSCO Piston-Ring Joints are available in a full range of sizes, with 4″, 8″, or 12″ traverse per slip, for pressures to 400 psi and greater and for temperatures to 800F and higher. Slip is completely guided . . . split external guide permits smaller manholes . . . limit stops prevent over-travel of slip . . . polished surface can not be scored because slip is in contact with packing only . . . misalignment is prevented by both internal and external guiding.

• Call an ADSCO representative or write for Bulletin 35-15H.

AMERICAN DISTRICT STEAM COMPANY, INC.
NORTH TONAWANDA, NEW YORK
Since 1877

ADSCO ENGINEERED PRODUCTS

EXPANSION JOINTS • HEAT EXCHANGERS • STEAM TRAPS
STRAINERS • SEPARATORS
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TEAM SERVICE by U·S·Steel Supply is up-to-date!

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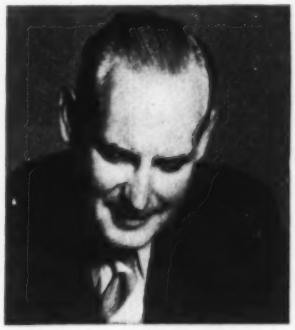
WAREHOUSEMAN

ASS'T. DIST. MANAGER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He specializes in solving *your* technical troubles!

• Our product specialist can give you expert advice on the selection of steel for a particular purpose, and on the choice of tools, equipment and machinery that can frequently speed up your production. He can interpret and develop specifications to fit your needs, and can advise on the methods of handling various kinds of steel and steel products during your production operations.

When you need technical advice from a product specialist, contact your U. S. Steel Supply salesman. He will put the right man to work for you.

U.S. STEEL SUPPLY

DIVISION

General Office: 208 So. La Salle St., Chicago 4, Ill.

Warehouses and Offices Coast to Coast

UNITED STATES STEEL

Fan and blower mounts... compressor units

Insulation materials... refrigeration lines

Ventilator hoods... duct straps

Pipe hangers... control units and wiring

Unit heater supports... sheet metal work

Beat down fastening costs, into steel or concrete with super-speed Ramset Jobmaster FASTENING SYSTEM

Prove for yourself the dollar-and-cents economy and amazing time saving by doing fastening jobs like these, and many others, with RAMSET JOBMASTER and Tru-Set Fasteners. Without any obligation, your local dealer will show you, right on the job, how thousands of RAMSET users have profited, for six years, from the super-speed RAMSET SYSTEM.

Compare JOBMASTER split-second fastening with any other method. See the compact, light-weight, one-piece tool, with fast opening and loading, trigger action and one-hand operation. Watch how Roto-set safety shield, angle fire control and the exclusive Red-Tip Pilot assure perpendicular contact of Tru-Set Fasteners with the work, for straight, firm penetration and highest efficiency.

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Gives detailed suggestions and diagrams for scores of jobs. Tells how to select the best Tru-Set Fastener and power charge. Points out many ways to do your fastening work faster, easier, at lower cost, with RAMSET SYSTEM. Ask your RAMSET dealer for your copy of *Modern Fastening Methods* or write us.

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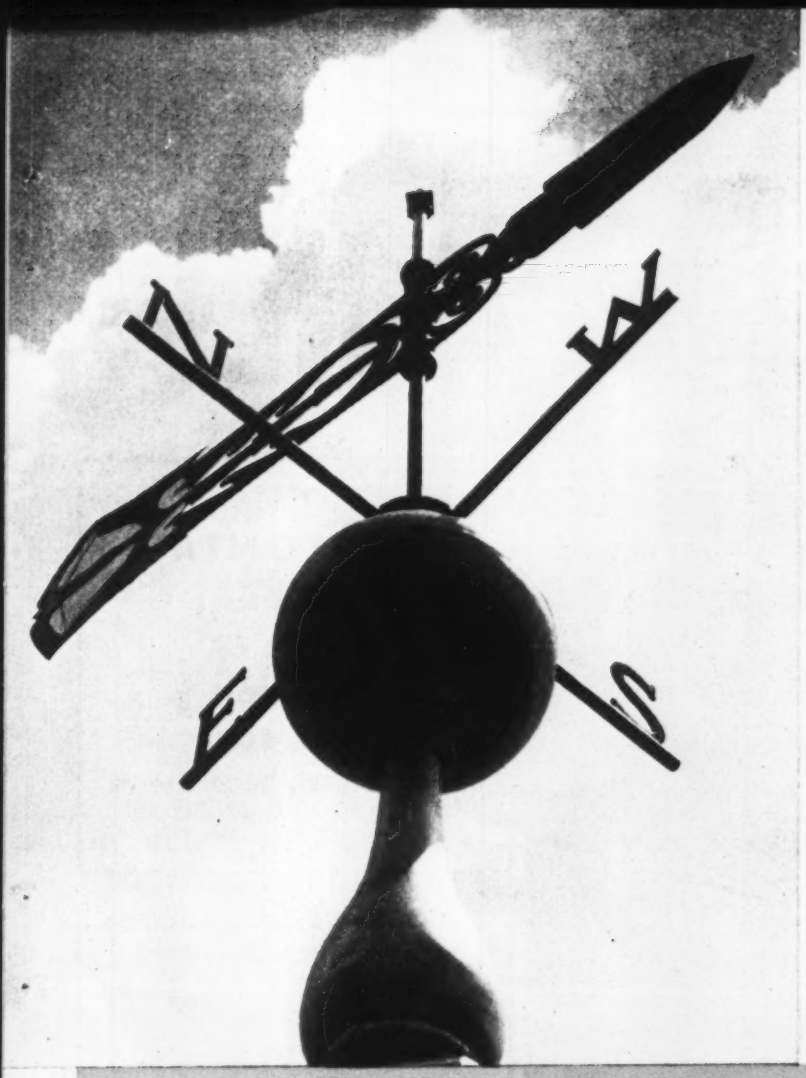

A Four-Way Selection

This photograph of a weather vane seems a good way to point out the fact that there are four different types of Midwest Welding Elbows (see below). These are more types than are manufactured by any other company. This greater selection is important to users of welded piping because it gives the engineer greater latitude in piping design and permits improvements and economies not otherwise possible in welded piping systems. For more information on this subject, ask for Catalog 48.

MIDWEST PIPING COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and Boston

Sales Offices:

New York 7—50 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 33—320 Anderson St. • Houston 2—1213 Capitol Ave.
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STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

MIDWEST "LONG TANGENT"

Same radius as ASA but tangent equal to 25% of nominal pipe size on each end. Saves pipe, layout and welding time. Costs no more than ASA. Sizes to 24".

ASA STANDARD

Dimensions conform to applicable size range of American Standard for Butt-Welding Fittings. ASA B16.9. Tolerances much less than allowable. Sizes to 28".

SHORT RADIUS

Recommended where space is limited. Sizes to 30". Also available with "Long Tangents" in sizes 14" to 30".

MIDWEST REDUCING

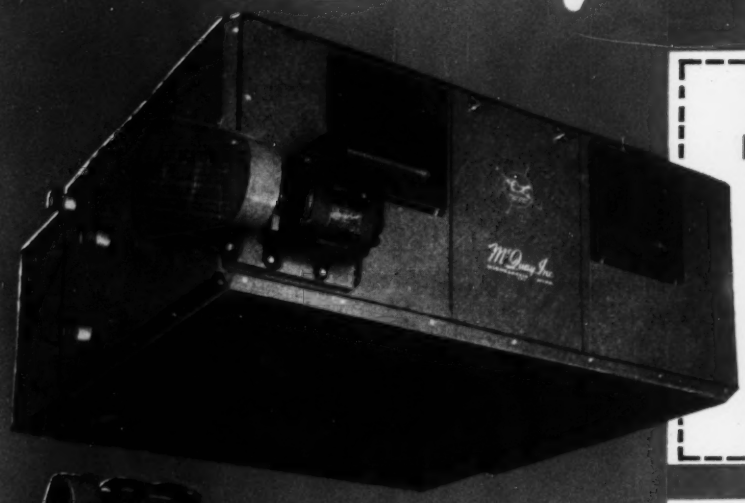
Takes the place of a straight size elbow and a reducer. Eliminates one weld, reduces pressure drop, easier to insulate. Sizes to 12", reductions to half size.

MIDWEST WELDING FITTINGS

IMPROVE PIPING DESIGN AND REDUCE COSTS

4108

McQuay's NEW



HORIZONTAL UNIT

WITH

WATER COIL

STEAM COIL

"V" FILTER SECTION

VERTICAL UNIT

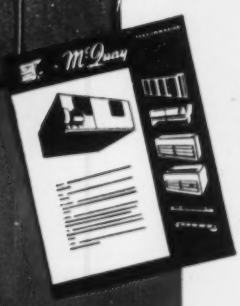
WITH

DIRECT EXPANSION COIL

STEAM COIL

FACE AND BY-PASS

FLAT FILTER SECTION



IN 14 MODELS!

WRITE FOR CATALOG

For complete features and specifications of McQuay's new Seasonmaster get your copy of Catalog No. 505. Representatives in all principal cities. Or write McQuay, Inc., 1601 Broadway St., N. E., Minneapolis 13, Minnesota.

SEASONMASTERS

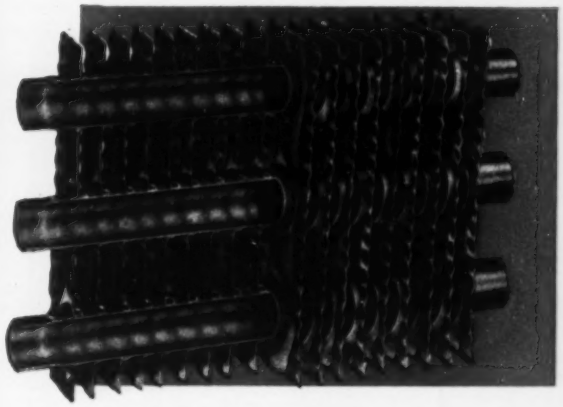
...everything you've wanted in Central Station Air Conditioners!

You've never seen a central station air conditioner that does so much, so well, under such a wide variety of conditions as McQuay's *new* Seasonmaster.

Fourteen models, in both horizontal and vertical types, many combinations of cooling and heating coils, a wide variety of accessories give you a unit adaptable to all year 'round demands . . . cooling and dehumidification, heating and humidification, positive ventilation, and air filtering.

Seasonmasters are furnished with ½" rigid insulation and are available with various air discharge arrangements. All parts are readily accessible for ease of installation and service.

McQuay construction of these versatile units is your assurance of quality and dependability. All coils are made with the exclusive McQuay Ripple-Fin construction for unmatched heat transfer efficiency. Seamless copper tubes are expanded into wide, smooth collars of aluminum fins. Headers are heavy wall, seamless copper tubes. In common with all McQuay products, the Seasonmaster was perfected after long and careful study, to give you maximum performance and trouble-free service.

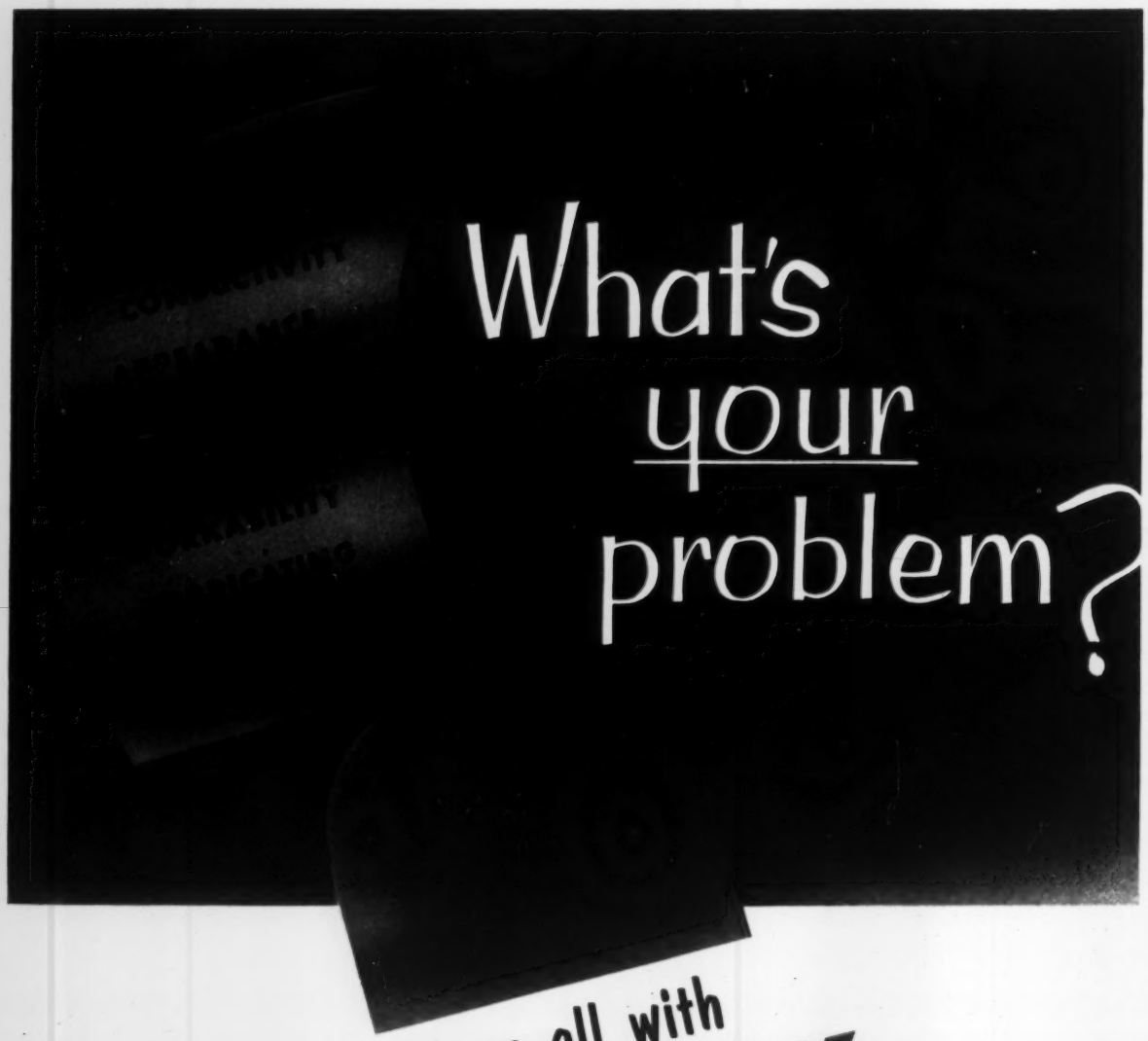


NOW...THE MOST UNIVERSAL LINE IN THE INDUSTRY!

Seasonmaster's wide range of Cfm and Btu capacities . . . its many practical combinations of coils and accessories add up to the most universal line of air conditioners in the industry. For air conditioning that will solve the problem to the complete satisfaction of both you and your customers, specify McQuay.

McQuay INC.

HEATING
AIR CONDITIONING
REFRIGERATION



answer them all with

HUSSEY
COPPER & BRASS

Yes, all of these physical properties and all of these production characteristics are yours when you specify genuine Hussey Copper. Some of them are natural to copper but Hussey's controlled quality manufacturing methods assure them all in Hussey Copper. Make your specification HUSSEY COPPER.

SEVEN COMPLETE WAREHOUSES

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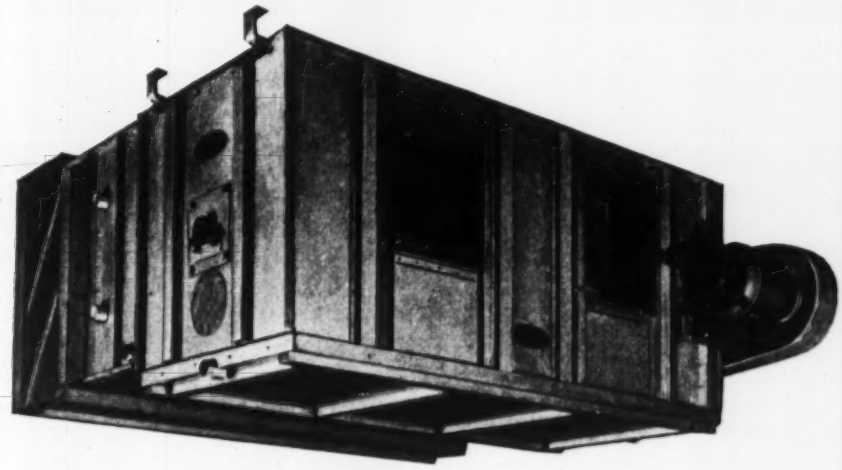
ROLLING MILLS AND GENERAL OFFICES
PITTSBURGH 19, PA.

HUSSEY
SINCE 1845

You can do more with
and make more out of

CARRIER SYSTEM WEATHERMAKERS



35 capacities from 5 to 100 tons

5 coils for each size—2, 3, 4, 5 and 6 rows deep

humidification optional

7 fan sizes from 2000 to 23,000 cfm

4 basic sections—fan, coil, bypass and filter

floor or ceiling installation

These new fan-coil units are plenty flexible—you can use them on any job! And they're priced so you can make a mighty attractive bid—and still make a profit! Figure on a Carrier Weathermaker and you'll give more, get more!

More cfm—fan operates below critical speeds, delivers more air with greater efficiency.

More heat transfer—revolutionary smooth-fin coils spaced closer to provide larger effective heat transfer surface.

More compact bypass—bypass damper section requires no external duct work, gives exceptional control at partial loads.

More protection—insulation in drain pan prevents condensation. Galvanized casing prevents corrosion.

More convenience—hanging bolts attached, simpler motor base, easily removable panels, no external insulation required, droppable drip pan, motor mounts right or left, top or front, coils connect on either side.

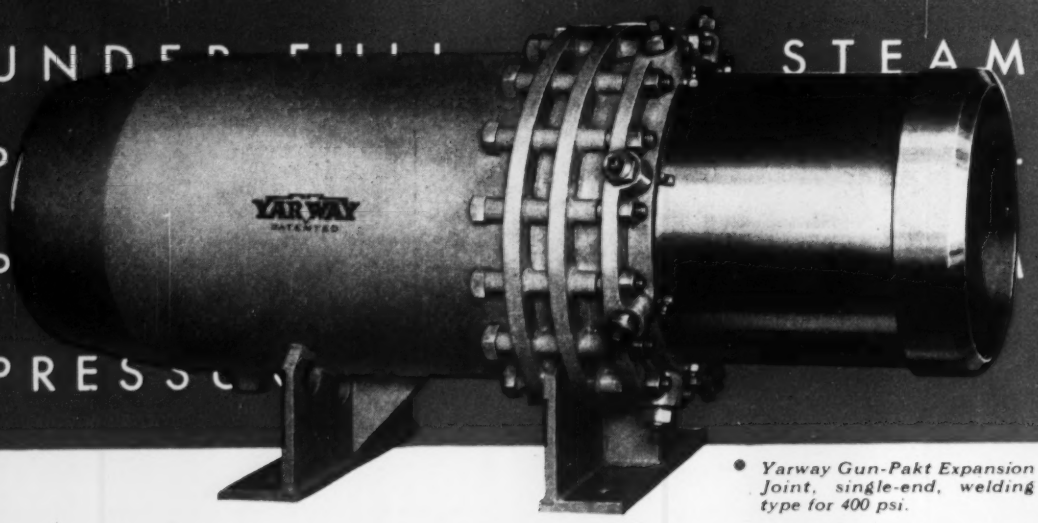
• • • •

This new line of Weathermakers is available to contractors through Carrier Branch Offices, Distributors and Dealers. Look for them in your Classified Telephone Directory. Or write Carrier Corporation, Syracuse, New York.

Carrier

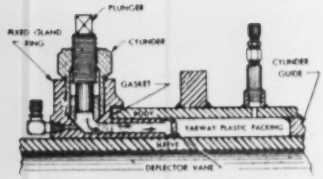
AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

GUN-PACKED UNDER FULL STEAM PRESSURE • GUN-PACKED UNDER FULL STEAM PRESSURE • GUN-PACKED



● *Yarway Gun-Pakt Expansion Joint, single-end, welding type for 400 psi.*

BEHIND IT...*AN ENGINEERING REASON*



Cross-section of Gun-Pakt feature.

More large central station heating plants are using Yarway Gun-Pakt Expansion Joints in their steam distribution lines than any other type. This popularity of Yarway Gun-Pakt Expansion Joints in public utilities, institutions and industrial plants is due to the engineering reason behind them . . . *they are packed by a gun under full steam pressure.*

No shutdowns of steam lines, no production delays . . . you just insert a plug of Yarway plastic packing, twist a wrench, and the joint is tight, the job is done.

Such labor saving features, combined with impressive records of low maintenance requirements, make Yarway Gun-Pakt Joints a natural selection for your steam lines. Certainly you'll find them worth investigating.

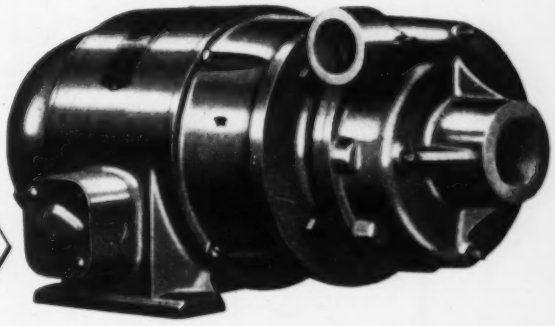
Write for Yarway Expansion Joint Bulletin EJ-1912.

YARNALL-WARING COMPANY
107 Mermaid Avenue • Philadelphia 18, Pa.

YARWAY | ***gun-pakt expansion joints***

HERE'S HOW TO START A PUMP PURCHASE

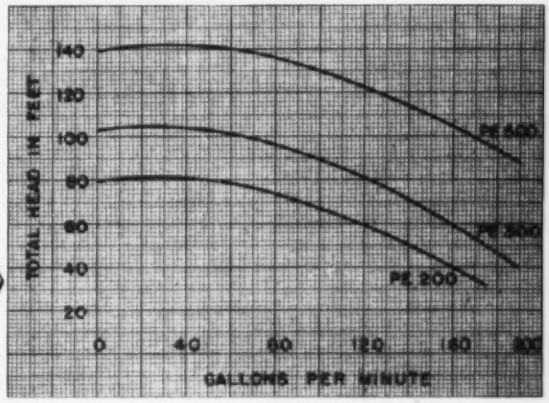
Right from an advertisement!

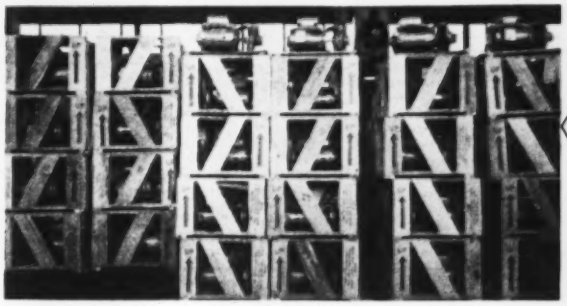


1 HERE'S THE 2, 3, 5 HP FACEMOUNT PUMP IN THE COMPLETE PEERLESS LINE OF LIQUID TRANSFER PUMPS FOR AIR-CONDITIONING.

PEERLESS PUMPS

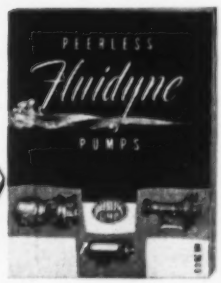
2 COMPARE ITS EXCELLENT HYDRAULIC CHARACTERISTICS. IT OUT-PERFORMS OVER ITS ENTIRE OPERATING RANGE.





3 AVAILABILITY ON ALL MODELS IS EXCELLENT FROM LARGE STOCKS AT BOTH OUR LOS ANGELES AND INDIANAPOLIS PLANTS.

4 YOU CAN BUY AND APPLY THIS PUMP AND SCORES OF OTHER SIZES FROM THIS 24-PAGE FULL LINE BULLETIN.



5 MAIL THE COUPON FOR BULLETIN TODAY. IT'S COMPLETE WITH SELECTION CHARTS AND DIMENSIONAL DATA FOR EVERY DAY USE.

We selected the type PE 2, 3 and 5 hp size Peerless Fluidyne pump, illustrated here, as representative of Peerless' broad line of liquid transfer pumps so successfully being applied to air-conditioning installations. Peerless builds a complete line of end-suction and horizontal split-case pumps for all your needs.

Write for a copy of our profusely illustrated 24-page bulletin and compare the complete line (¼ to 150 hp) of Fluidyne pumps. You'll see why these compact, durable, efficient and economical end-suction pumps are so popular with both installers and customers for air-conditioning jobs. Do it today!

Peerless builds *Dependable* Pumps

PEERLESS PUMP DIVISION
Food Machinery and Chemical Corporation
301 West Avenue 26, Los Angeles 31, California

Please send us a copy of your Peerless Fluidyne Line Pump Bulletin No. B-2300

NAME _____

COMPANY _____

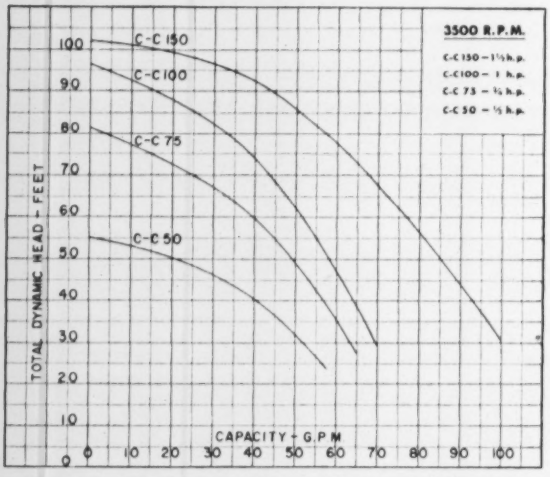
ADDRESS _____

CITY _____ STATE _____

H P & A C

New CC CLOSE-COUPLED SERIES PUMPS

Set new performance standards



Each pump operates over the entire range of its curve without motor overload.

The New C-C Series pumps are more than just an improved line—they are an engineering achievement.

They definitely establish entirely new standards in close-coupled pump performance for:

Cooling Towers
Air Conditioning
Chilled Water Circulating
Hot Water Circulating
Pneumatic Water Systems
Booster Systems

The C-C Series pumps combine pump and motor in a single compact unit, eliminating coupling and alignment problems and assuring easy installation.

C-C Series pumps are equipped with a Leak-Proof "Chicago Mechanical Seal" consisting of a fixed-in-place carbon ring on a ceramic seat which is extremely hard and resistant to wear and corrosion. No maintainance or adjustment is necessary. No expensive piping is needed from drip pocket to drain. No messy floors.

See curves above for ½, ¾, 1 and 1½ H.P. models or write for Bulletin 108 F.

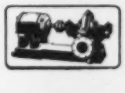
All models in stock for immediate shipment.

CHICAGO PUMP COMPANY

BUILDING and INDUSTRIAL DIVISION

622 DIVERSEY PARKWAY **CHICAGO 14, ILLINOIS**

Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps
Pneumatic & Tankless Water Systems.



Flush-Kleen Sewage Ejectors
Little Giant & Non-Clog Bilge Pumps
Pumps for every industrial use.

The Coupling that gives you these 7 Design Features

1 **ALL STEEL** construction from high grade steel castings with fine tool finished surfaces.

2 **ONE PIECE COVER SLEEVE** is one solid forged steel unit for added safety at high speeds.

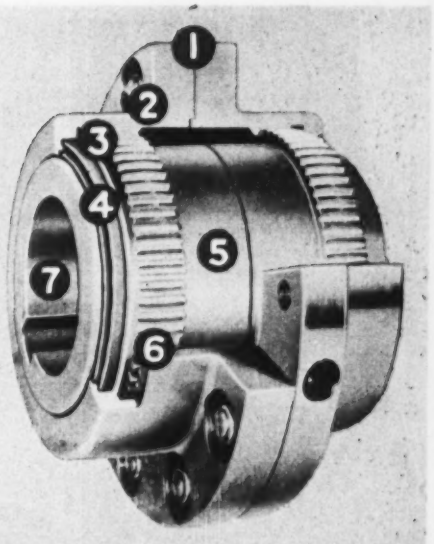
3 **AUTOMATIC LUBRICATION** with ever-present oil film between hub and sleeve to prevent friction or wear.

4 **POSITIVE SEAL** hermetically seals coupling against oil oxidation and keeps ample supply of CLEAN oil inside.

5 **LONGER LINING UP SURFACE** insures easy, accurate initial alignment and full capacity to handle any subsequent misalignments.

6 **COVER SLEEVE BEARING** prevents any added pressure to either shaft; eliminates adverse end crank action on shaft.

7 **LARGER BORE** permits use of smaller physical capacity for same size shaft and reduces rotating weight.



WALDRON GEAR TYPE COUPLING

most economical to buy and to use!

Its design refinements, rugged construction and operating advantages account for the notable performance records of the WALDRON Gear Coupling. Its reputation for providing a longer life of trouble-free service has for many years made it the first choice of practically all leading equipment builders. When you specify WALDRON you are getting maximum protection against coupling failure, costly shut-downs and replacements and damage to expensive equipment. Write for Catalog 57.

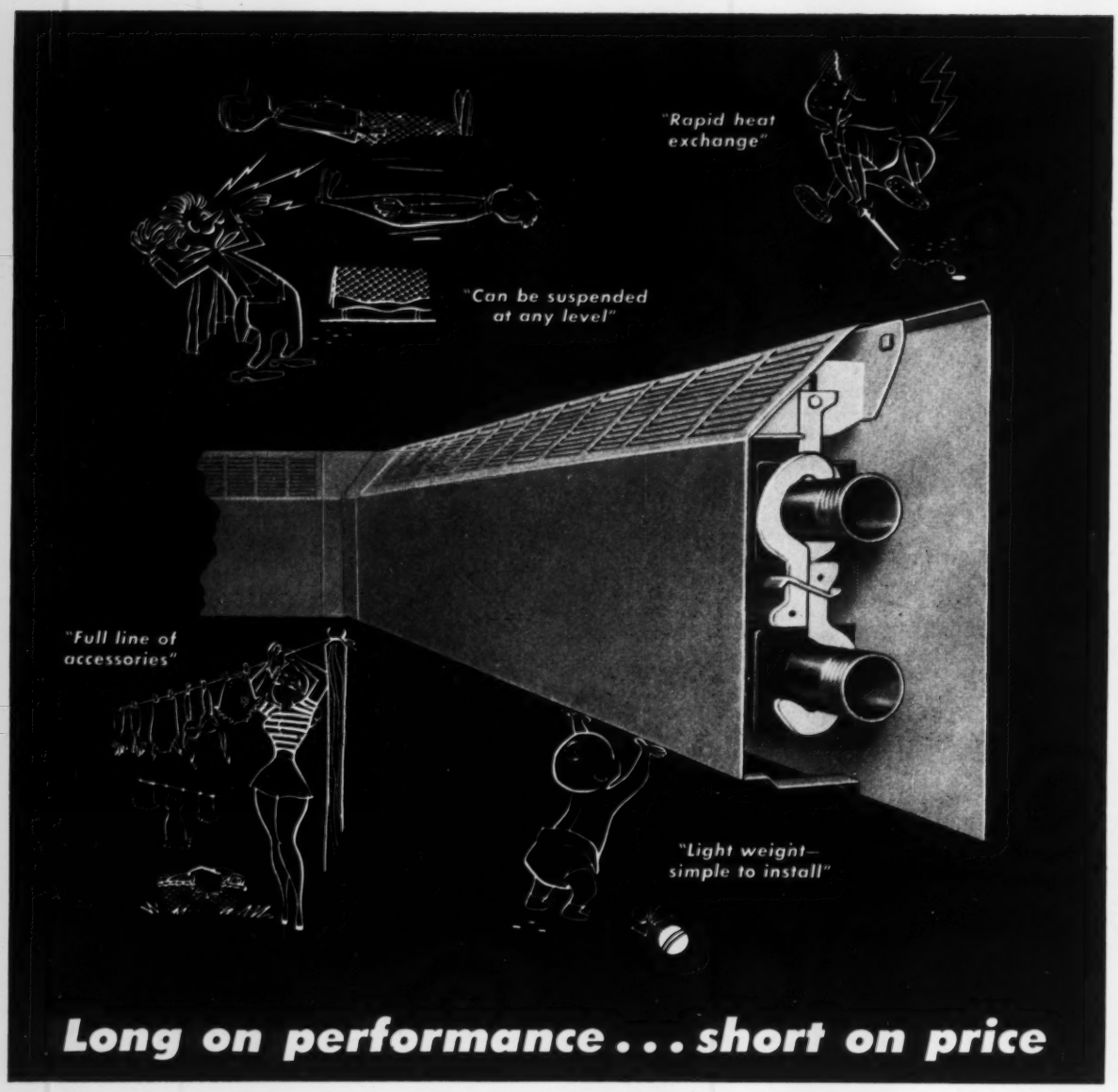
- ✓ Available in Standard, Heavy Duty Mill, Mill Motor, Floating Shaft, Jordan, Shear Pin, Cut-Out, Vertical Floating Shaft and Spacer types. A type and size for every purpose.
- ✓ Standard design can be quickly and easily adapted for any special application.
- ✓ Waldron nylon non-corrosive, non-lubricated gear coupling for small fractional H.P. drives. Nothing to wear out. No maintenance.

JOHN WALDRON CORPORATION

Waldron Series "A" and Junior Gear Couplings · Francke Pin Type Coupling · Anchor-Waldron Overload Cut-Outs

NEW BRUNSWICK • NEW JERSEY

Sales Representatives In Principal Cities • In Canada—Peacock Brothers, Ltd.



Long on performance . . . short on price

For low-cost, along-the-wall radiation that looks good *anywhere* —be sure to look at Dunham's new Fin-Vector Radiation.

Three attractive cover designs, plus a complete line of accessories, give the new Fin-Vector a tight, trim, "finished" appearance . . . suitable for any surroundings.

Fin-Vector transfers heat rapidly, operates efficiently at any height above 4" from the floor. Installation costs are low since Fin-Vector goes in so fast, requires few supports, or little on-the-job cutting. Write for full details.

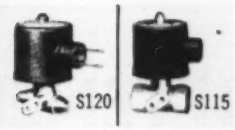
Send For Free Bulletin

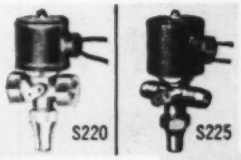
Data sheets 1256-2 fully describe and illustrate design and construction features. For your free copies write to: C. A. Dunham Company, Dept. 5, 400 W. Madison Street, Chicago 6, Ill.

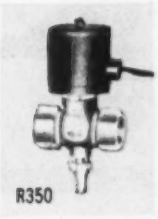
DUNHAM **FIN-VECTOR RADIATION**

DUNHAM 1903-1953 *Quality first for fifty years*

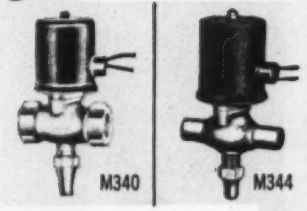
ANOTHER QUALITY PRODUCT OF C. A. DUNHAM COMPANY — CHICAGO • TORONTO • LONDON



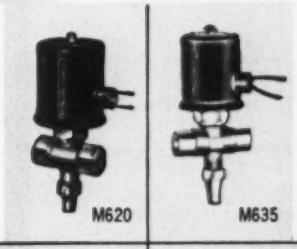




ALCO SOLENOID VALVES

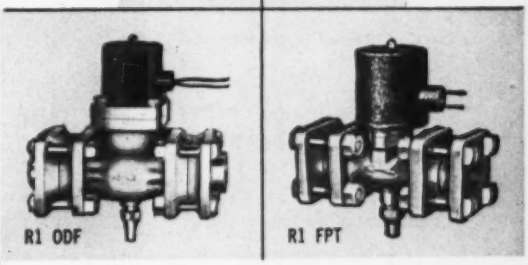


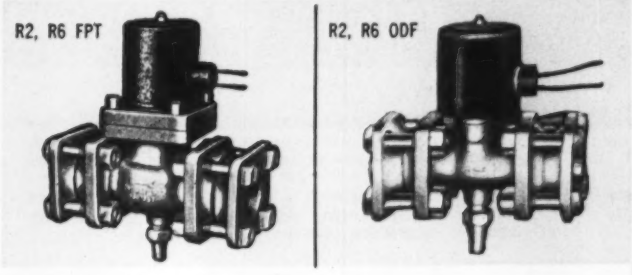
the complete line



- **for** Freon-12, Freon-22, Methyl Chloride and Ammonia
- **for** liquid line, suction line or hot gas discharge service
- **for** brine, water, steam, air, oil
- **for** all types of electric current
- **for** wide range of connections: ½" to 2⅝" solder, ⅜" to 2" pipe thread
- **for** use with thermostats, float switches, timers, and many other control devices

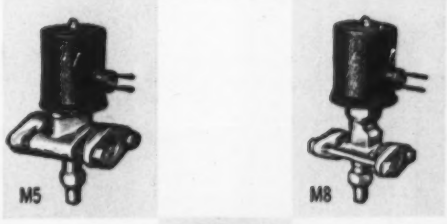
Special valves for special applications are available.





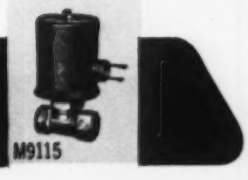
Our Bulletins 173 and 182 give complete technical information. Send for your free copies today.

SEE YOUR ALCO WHOLESALER



ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.



BRUNER
WATER SOFTENERS & FILTERS

WATER SOFTENERS
FOR INDUSTRY

Some recent installations of BRUNER industrial equipment:

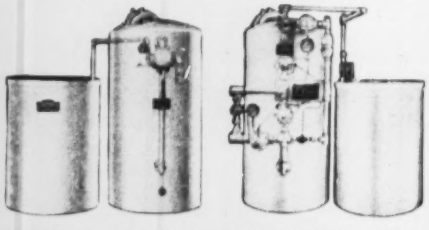
- Flint, Michigan — Chevrolet Division, General Motors
- Amarillo, Texas — Pantax Ordnance
- New Orleans, La. — Jung Hotel
- Peoria, Ill. — Methodist Hospital
- Jacksonville, Florida — Jacksonville Power Plant #2
- Lansing, Mich. — Michigan State College
- Exeter, Calif. — Exeter Memorial Hospital

Hundreds of other huge installations of BRUNER softeners and filters from coast to coast and from border to border include almost every state in the Union.

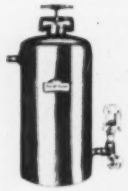
These new improved single units now available from stock, deliver 1,200,000 GR capacity with flow rate up to 150 GPM.

Twin units provide double capacity at twice the flow rate. Special units with up to 10,000,000 GR capacity at 800 gallons per minute can be supplied.

Bruner exclusive type automatic backwash control has no moving parts, guarantees no loss of mineral at high pressures yet assures positive cleaning of mineral bed at low pressures.
Dowex Lifetime Mineral is supplied as standard. Green sand or synthetic zeolite can be furnished. Your inquiry will receive prompt attention.



Dial-O-Matic and Solo Valve Heavy-duty models 80 to 160 GPM — 600,000 to 1,200,000 GR carried in stock.

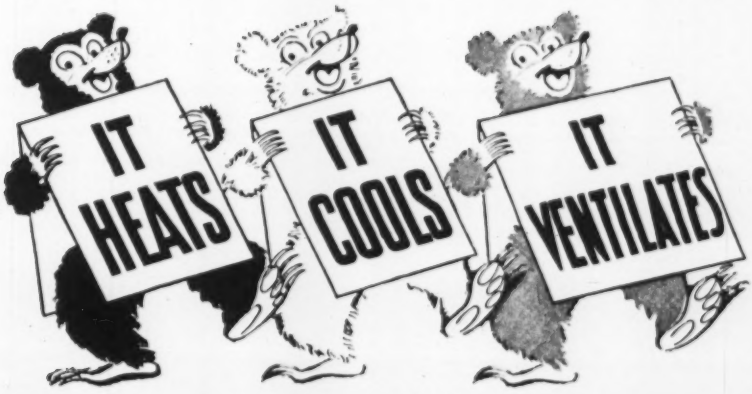


Brucex Feeder for corrosion control.

"America's Most Complete Line of Quality Water Softeners and Filters".

Offices in principal cities.

BRUNER CORPORATION • 2318 North 30th Street MILWAUKEE 45, WISCONSIN



Yes, Modine Cabinet Unit gives you ALL 3!

TYPE FF for heating only. Basic unit designed for exposed or recessed installation. Floor, wall or ceiling mounting.

TYPE BT for heating, cooling (in floor-mounted position), ventilating, with or without ducts. Floor, wall or ceiling mounting.

IF you need economical equipment for heating, cooling and ventilating—and the expense of unit ventilators or air conditioners is not warranted—you'll find the perfect answer in Modine's newly expanded line of Cabinet Units.

Here, in a single unit, you can get quick, positive, quiet distribution of heated or cooled air . . . with or without ducts. Inexpensive accessories permit introduction, filtering, heating and distribution of fresh outside air for ventilation.

Whether it's new construction or modernization work—Modine Cabinet Units harmonize perfectly with any interior. You can choose from five different models—some for heating with steam or hot water only . . . others for heating plus cooling with chilled water.

Next time you have a heating application for commercial, institutional or public buildings—check Modine Cabinet Units. They're the low-cost answer to year 'round comfort.

Modine CABINET UNITS

Tear out coupon and mail today for your free copy of 28-page, profusely illustrated Bulletin 552. Or see your Modine representative listed in your classified phone book.

MODINE MFG. CO.
1509 DeKoven Ave., Racine, Wis.

Please send me immediately a free copy of 28-page Bulletin 552, "Modine Cabinet Units."

Name .....
Firm .....
Address .....
City ..... Zn .... State .....

C-1166

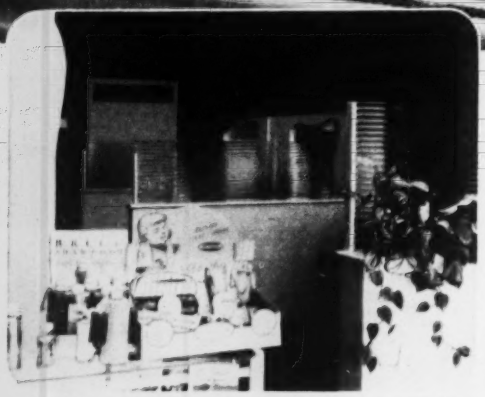
TRADE FRICK MARK®

UNIT AIR CONDITIONERS

Meet every commercial need. Available in sizes of 3, 5 and 7½ horsepower, these superior conditioners are the choice of the better class of users.

Extra-dependable: most of those installed in 1938 are still operating. You get this built-in reliability only when you specify Frick.

Let us show you their many other advantages: write for Bulletin 522. Some desirable territories still open for Distributors.



The Beauty Salon is one of eleven businesses using Frick Unit Air Conditioners at Freedom Shopping Center, Baltimore, Md.

Two Carvel Dari-Freeze Stores on Long Island are equipped with Frick 5-hp. Unit Air Conditioners

DEPENDABLE REFRIGERATION SINCE 1882

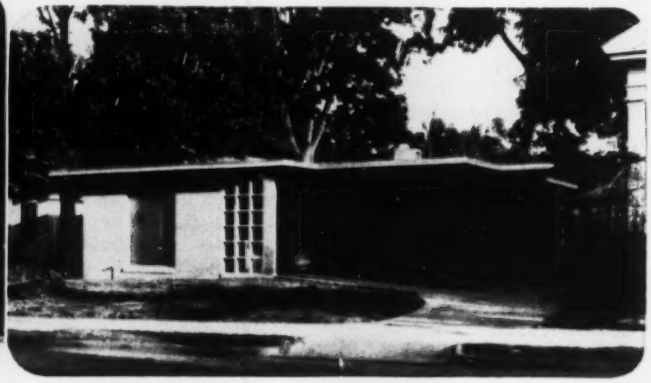
FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery

The Frick Unit blends-in well at the Boulevard Restaurant, 2407 Broadway, New York

Dr. Howell's Clinic at Canton, Miss., typifies the adaptability of Frick Units to varying needs



THE BEAUTIFULLY STYLED

Aerofuse

TYPE "P" SERIES

CEILING DIFFUSER

Aerofuse – a famous name in diffusers – is now presented in an entirely new design that sets a new high in appearance and performance at the vital point of air delivery.

BEAUTIFULLY STYLED, the four diffuser types in the new line feature matching facial contours. All sizes have the same number of rings. Thus uniform appearance is assured when more than one type, or various sizes, are installed in a conditioned space.

TYPES AVAILABLE . . . Type "PA" provides pattern adjustability . . . Type "PF" is a fixed pattern diffuser . . . Type "PS" high capacity diffuser for industrial applications . . . Type "PR" supply and return diffuser.

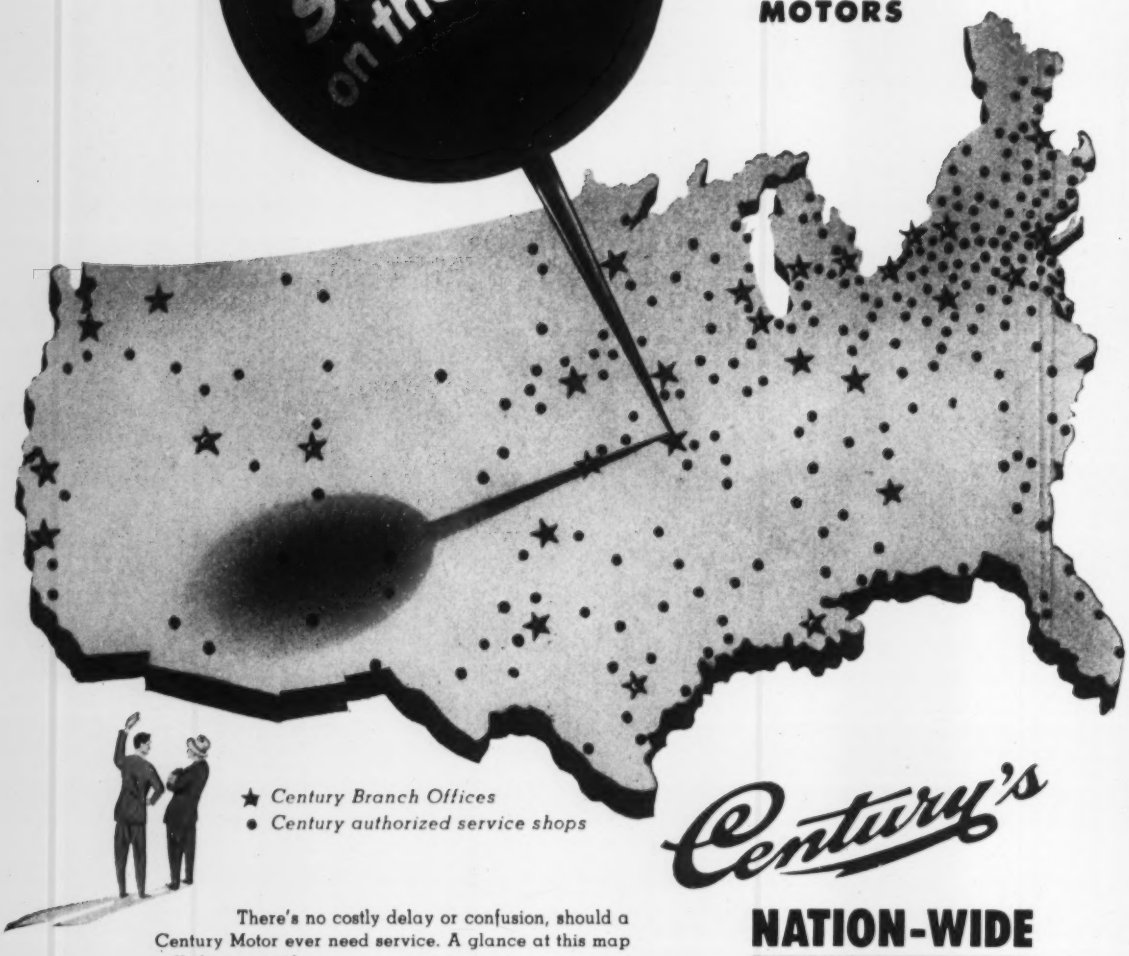
For complete details, write for Catalog No. 105.

TUTTLE & BAILEY INC

NEW BRITAIN, CONNECTICUT

SKILLED SERVICE on the SPOT!

TO HELP YOU SELL MORE Century MOTORS



★ *Century Branch Offices*
● *Century authorized service shops*

Century's

NATION-WIDE AUTHORIZED SERVICE ORGANIZATION

There's no costly delay or confusion, should a Century Motor ever need service. A glance at this map will show you why.

Hundreds of trained electric motor repair men in established independent service organizations are located convenient to motor users throughout the United States. They are equipped to give Century Motors the same kind of skilled care that is used in their manufacture.

They carry a stock of Century Motor parts, and also some standard motors to be used as replacements. These authorized Century service shops are authorized to render immediate decisions regarding warranty service on Century apparatus. Your customers will appreciate this reliable service organization.

For a list of service stations—or for more information on your opportunities for success with Century Motors, write us today.

Century C MOTORS

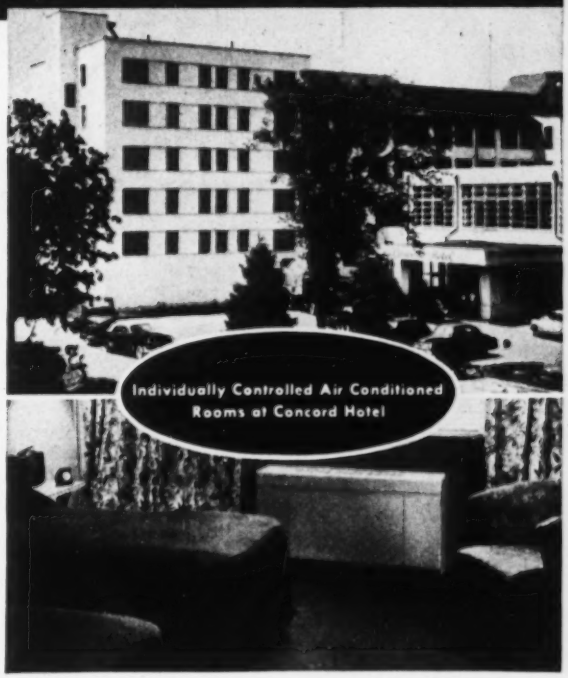
CENTURY ELECTRIC COMPANY • 1806 Pine Street, St. Louis 3, Missouri
Offices and Stock Points in Principal Cities

752

Another interesting REMOTAIRE installation!

Individual-room remote type units in resort hotel provide year 'round air conditioning

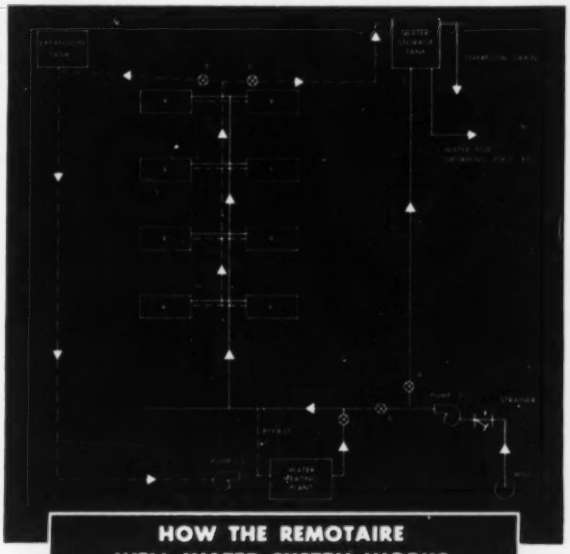
Summer cooling... winter heating



● The Concord Hotel, Kiamesha Lake, New York, found the answer to efficient, economical year 'round air conditioning through the installation of the Remotaire Well Water System—one of a number of different Remotaire systems available for multi-room buildings.

The Remotaire Well Water System may be used in localities where well water is known to be available in adequate supply, proper temperature, and of good quality. The cold well water is used in lieu of a water chilling plant. Consisting of Remotaire Room Units in each room connected by a piping system to the central plant equipment (as shown in the diagram), this system costs less to install and less to operate. Individual control of each Remotaire unit allows the occupant to choose the room temperature that suits him best without affecting adjoining rooms.

This resort hotel installation is another example of the versatility of the Remotaire for hotels, motels, hospitals, apartments, and other multi-room buildings.



HOW THE REMOTAIRE WELL WATER SYSTEM WORKS

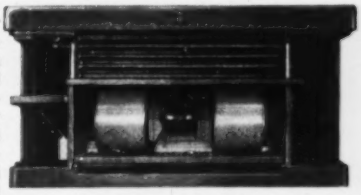
The Remotaire Well Water System consists of Remotaire Room Units in each room connected by a simple piping system to the central plant equipment—a well with pump, water heater, water circulating pump, expansion tank, storage tank and water filter or strainer as shown above.

FOR COOLING—Valves A and C are closed. B is open. Pump No. 1 pumps water from well to Remotaire units on each floor from which it travels thru valve D to storage tank on roof. This water is usable for swimming pool or other purposes.

FOR HEATING—Heating circuit includes Water Heater, Valve C, Valve E, Expansion Tank, Pump No. 2 and bypass. For operation, close Valves B and D, start Pump No. 2 and boiler, and the hot water circulates through the system.

When cooling is not required, well water may be used for other purposes, and can be pumped direct through Valve A to Water Storage Tank by Pump No. 1.

Top Quality Construction... Easy To Install



The Remotaire is sturdily built of heavy-gauge steel—plus a reinforced air grille—with a bonderized, baked-on semi-gloss enamel finish. All air passages are acoustically insulated for thermal efficiency and quietness. Coil is designed for right or left hand connections. Spacious end compartments permit easy access to coil connections and controls. Adaptable to a variety of ventilation systems, the Remotaire is ideal for modernization as well as new construction and is available in three models—200, 400 and 600 cfm.

Write for Remotaire Brochure, Form 298.

American Radiator & Standard Sanitary Corporation
P. O. Box 1226, Pittsburgh 30, Pa.

AMERICAN-Standard
HEATING-COOLING

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE
DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

GLOBE

specialization gives you
"Tops in Quality"

ALLOY STEEL TUBES

SEAMLESS — MECHANICAL — PRESSURE — CORROSION RESISTANT

TYPICAL ANALYSES:

Carbon	5 Chrome ½ Moly
Carbon ½ Moly	7 Chrome ½ Moly
½ Chrome ½ Moly	8 Chrome ½ Moly
1 Chrome ½ Moly	8 Chrome 1 Moly
1¼ Chrome ½ Moly	9 Chrome 1 Moly
2 Chrome ½ Moly	3% Nickel 7% Nickel
2¼ Chrome 1 Moly	5% Nickel 9% Nickel

AISI Types: 304-321-347-316-309-310-405-410-430-443-446

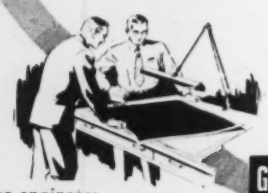
Analyses to meet conditions where heat, corrosion, pressure and structural strength are involved.

SIZE RANGE — WALL THICKNESS:

½ to 6 inches O.D. — wall thickness .035 to 1.000 inch.

TYPICAL APPLICATIONS:

Pressure tubes — Superheater tubes — Condenser tubes — Still tubes — Evaporator tubes — Barrel tubes — Oil-well Pump Barrels — Mechanical tubes — Aircraft tubes — Propeller tubes — Rollers for Transmission Chains.



Globe engineers gladly give you the benefit of specialized knowledge of stainless steel tubing in a wide range of services and applications — to improve your product — to cut costs.

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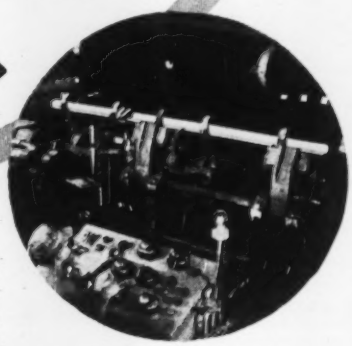
The heating, piercing, rolling of seamless tubes is controlled at every step for uniformity, close tolerance.



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EXTRA MARGIN OF SAFETY... The tremendous sealing power of the Flexitallic Spiral-Wound Gasket is sometimes taken for granted in this age of jet propulsion and atomic energy. Yet, it is the extra margin of safety built into each Flexitallic Spiral-Wound Gasket that has made possible many of the great developments in aviation, atomic research and development, process industries, power plants, ships of the Navy and merchant marine . . . Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally wound V-crimped plies of required metal with alternating plies of proper filler results in a resilient gasket having characteristics of a calibrated spring. Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 4000 lbs., from extreme sub-zero to 2000° F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". With Teflon filler for corrosive chemical conditions. Write us your requirements . . . Flexitallic Gasket Company, 8th & Bailey Streets, Camden 2, New Jersey. Representatives in principal cities. Consult classified telephone directory.

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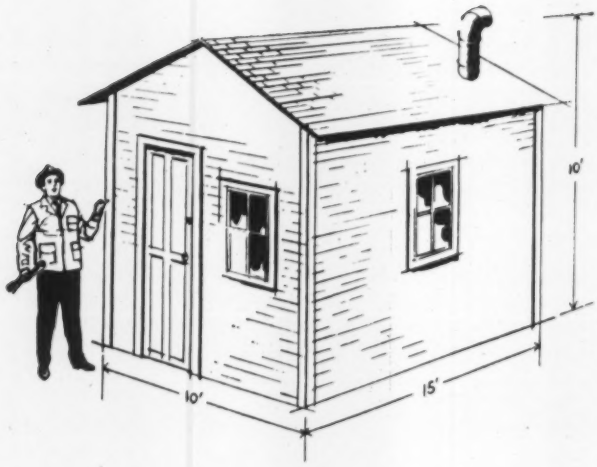


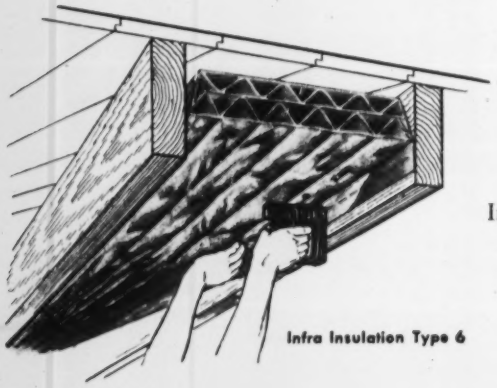
ORDINARY INSULATION WOULD TAKE 140 SUCH SHACKS

Storage problems and waste are drastically reduced for contractors, builders and dealers, both at the building site and on their own premises, when they use multiple accordion aluminum insulation. While 1000 sq. ft. of ordinary insulation sometimes weighs a ton and usually occupies 25 cartons of 175 cu. ft. in all; one standard carton of multiple accordion aluminum, such as Infra Type 4, holds 1,000 sq. ft., weighs 46 lbs., and occupies 1¼ cu. ft. Warehousing, transportation and handling bills are naturally insignificant in comparison.

Multiple accordion aluminum's slight mass, scientific compartmentation, and zero permeability to water vapor are decisive in protecting buildings against destructive condensation. The "warm" side of multiple accordion aluminum insulation, and each component layer almost immediately assumes the temperature of the air in contact. The "cold" side remains a trifle warmer than the air *it* contacts, thereby raising its dew-point. With no dew-point attainable, condensation is prevented.

The light-weight but tough aluminum sheets, and the automatic and permanent compartmentation combine to bar unwanted heat loss or intrusion. The metallic sheets throw back the heat rays at a 97% rate, emit at 3%. Their insignificant mass and the nonconductivity of the air layers prevent conduction flow. The construction has 5 integral barriers to convection.

A popular commercial form of multiple accordion aluminum is Infra Insulation, Type 6. With sufficient practice, a man can install 2,000 sq. ft. a day. The cost of installation, in new construction between wood beams, material with labor, is less than 10¢ sq. ft.


Infra Insulation Type 6

INFRA THERMAL FACTORS. TYPE 6

Up-Heat	**C.089, R 11.23 =**	**4 3/5" dry rockwool**
Wall-Heat	**C.073, R 13.69 =**	**5 5/8" dry rockwool**
Down-Heat	**C.044, R 22.72 =**	**9" dry rockwool**

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THE EDITOR'S PAGES

AS THIS ISSUE IS BEING made ready for the press, the Heating, Piping and Air Conditioning Contractors National Association is gathered in Chicago for its 64th annual convention. Optimistic in tone and well-attended — the same qualities which have marked this year's meetings of other societies and associations concerned with heating, piping and air conditioning — the successful gathering reflected the ever-growing need for and the wide public recognition of the importance of the services its members perform. HPAC will report the details of the convention next month.

'53 CONSTRUCTION EXCEEDING ALL-TIME HIGH OF '52

THE CONSTRUCTION BOOM broadened its base in April, aiming at a 1953 total equalling or exceeding the all-time high of 1952.

The F. W. Dodge Corp. four-month total of reports of contracts awarded in the 37 eastern states was $5,186,238,000, or 10 percent above the corresponding total for 1952. The three-month total was 11 percent above 1952.

If the total should slip the same amount in each of the remaining eight months, 1953 would still be ahead of 1952 at the end of the year.

Expenditures for new construction increased by 8 percent during April to $2.6 billion, and were 5 percent above April 1952, according to preliminary estimates of the U. S. Labor Department's Bureau of Labor Statistics and the Building Materials Division of the U. S. Department of Commerce.

During the first four months of 1953, new construction with a total value of more than $9.6 billion was put in place, an increase of 6 percent over the 1952 figure, according to the government report.

APARTMENT TENANTS "DEMAND AIR CONDITIONING"

APARTMENT HOUSE TENANTS want "guaranteed weather" these days with the result that air conditioning has become "the biggest new idea" in apartment building, according to an article in the Architectural Forum.

Apartment investors everywhere face the fact that tomorrow's apartments may have to be air conditioned to compete with the lower costs and rents of yesterday's buildings. For the same reason, investors today would hardly dare put up an office building without air conditioning.

"Apartment air conditioning has made the most headway along the east coast from New York to Florida and across the south to Texas," the article says. "But increasing activity is reported almost everywhere.

"For instance, three big, fully air conditioned apartment houses were recently built in Pittsburgh; others have risen in Roanoke, Indianapolis and Wichita. Still others are planned for St. Louis and Chicago . . . as many as 500 air conditioned apartment structures ranging from walk-ups to 26-story skyscrapers have gone up since the war.

"The rising demand for apartment air conditioning is perhaps best illustrated by what is happening at New York City's Manhattan House. To hold down costs, central cooling was not provided. But realizing that some of their well-heeled tenants might want air conditioning, the owner spent $60,000 for extra wiring and outlets so tenants could install room coolers.

"However, in last summer's heat, tenants swamped the owner with requests for still more wiring and outlets. At the last count, 247 of the 580 tenants had room coolers — a total of 400 cooling units. Some apartments have three or four units apiece and new coolers are constantly appearing in the windows."

The Forum reports two big houses have just gone up on New York's East Side with central cooling systems, that Philadelphia's high rent market has been cracked by air conditioning, and that practically all of Washington's elevator apartments have been air conditioned since the war.

Because air conditioning is insurance against future obsolescence — especially in the high rent bracket and high temperature belt — the Federal Housing Authority favors central cooling, calls it a "very desirable plus factor," according to the magazine, noting that FHA will usually underwrite the first cost for apartment air conditioning.

Costs, the article notes, depend on the size of the structure and the type of system used, among other factors, but, including heating, central air conditioning systems are running 10 to 12 percent of the total cost for new apartment buildings, with heating alone running to 4 to 5 percent.

SEE RECORD-BREAKING AIR CONDITIONING YEAR

THE AIRTEMP DIV. of Chrysler Corp. has announced that its 1953 production of air conditioning units is scheduled to be 50 percent greater than 1952 output. Due to record-breaking shipments in the first quarter of 1953 and an unprecedented number of orders for all types of air conditioners, Airtemp found it necessary to double its planned 25 percent increase to meet the present demand, stated J. F. Knoff, vice president and general sales manager. Shipments of "packaged" air conditioning units — not including room air conditioners — rose 92 percent over the number shipped in the first quarter of 1952, and 10 percent higher than the number shipped in any first quarter in Airtemp's 19 year history.

AIR CONDITIONING SALES this year will far surpass the record peaks our industry set in 1952, regardless of whether or not 1953 is a hot year, W. B. Cott, sales manager for Westinghouse's air conditioning division has predicted. He based his conclusions on observations and interviews during a recently conducted coast-to-coast application engineering school for air conditioning distributors. "All signs point to air conditioning rapidly becoming a year 'round business, with the peak season problem leveling out for both manufacturer and distributor," says Mr. Cott.

ROOM AIR CONDITIONER sales are bettering the spring sales marks of 1952, according to Robert A. Seidel, of RCA Victor. "Optimistic predictions for the sale of room air conditioners during 1953 apparently were well

founded," he said. "Dealers in the southwest, midwest and on the eastern seaboard report an early start on the sales season." Without a doubt, he states, the room air conditioner industry is in a period of growth that will place it among the nation's leading industries. Most forecasts place 1953's total unit sales at about half a million, which would represent an increase of nearly 50 percent over last year's sales. However, Mr. Seidel believes the forecast is conservative, and that the industry's unit sales will be considerably higher — possibly reaching the 700,000 mark, or about double last year's.

URGES BETTER SELLING IN HEATING INDUSTRY

THE HEATING INDUSTRY is still selling "nuts and bolts" while its competitors are selling "dreams and prestige and health and security." That is the opinion of Tom McDonald, vice president of Minneapolis-Honeywell Regulator Co.

"As an industry," he told the annual convention of the Oil-Heat Institute of America, "we have not done as good a job of putting our story into terms that make people want to buy as our competitors have done."

AIR CONDITIONING "MUST" FOR RETAIL STORES

A SURVEY BY the research department of Women's Wear Daily has indicated that over 80 percent of the leading department and specialty stores throughout the country had air conditioning in all or some part of their stores in 1952. The study was based on reports from 435 "key stores" in 57 cities.

Twenty-five percent of the stores not completely air conditioned plan either to install air conditioning systems or to expand present main store set-ups this year. Fifteen percent plan such installation or expansion for their basement operations during 1953.

Of all the stores polled, 65 percent were completely air conditioned and 23 percent partly air conditioned.

Ninety-three percent of the store executives queried reported that air conditioning had increased sales during the three hottest months of the year, according to Marvin Klapper, survey manager for Fairchild Publications.

"QUOTE"

"In deciding on the one best solution — the one to put into effect — the consulting engineer serves his highest function. To do this successfully he must have an intelligent understanding of the specific problems of the business or agency with which he is dealing.

"In addition, and equally if not more important, he must be able to bring to bear on the problem his wider knowledge and experience resulting from having coped with similar and related problems in other circumstances and in other companies."—*Colonel S. H. Bingham, in an address at a meeting of the American Institute of Consulting Engineers.*

"FORTUNE" LOOKS AT THE "AIR CONDITIONING BOOM"

IN AN ARTICLE in its May issue, the magazine Fortune takes a look at the air conditioning industry "for an idea of the kind of competitive rough-housing that made — and still makes — the U.S. economy hum."

Based on the proposition that people tend to buy new products at an ever faster rate, a "growth formula" reported in the article indicates that even the optimistic predictions of the number of home air conditioning installations for the next few years are conservative.

But the article is not confined to residential applications. The prospects in the industrial and commercial field "are enormous, and sales should come easier and increase faster," says Fortune.

MARC BLUTH RESIGNS AS SMA SECRETARY

THE RESIGNATION OF Marc G. Bluth as executive secretary of the Stoker Manufacturers Association was announced last month by SMA's President L. C. Dubs.

"It is with the deepest regret that it was necessary to accept his resignation," Mr. Dubs stated, "but it is tempered with the knowledge that the association and the small underfeed coal stoker industry will continue to have the benefit of Mr. Bluth's long experience and seasoned guidance in an advisory and consulting capacity. This is because the association has approved the establishment and maintenance of national office headquarters in Washington, D. C., where Mr. Bluth will be located permanently as a staff member of the National Coal Association. These two associations are cooperating so that Mr. Bluth will be in a position to render advisory and consulting service to the stoker organization and industry."

The directors of the SMA have decided to postpone the annual meeting until fall, when it will be held in Cleveland.

GRADE PLANT SITE IN WHIRLWIND JOB

"BACK-SCRATCHING" AND earth-scratching went together in a recent cutting and filling operation in Gardena, Calif., a Los Angeles suburb, that saw 80 excavating companies, using $3 million worth of equipment, grade a 16 acre factory site in a whirlwind two-day operation.

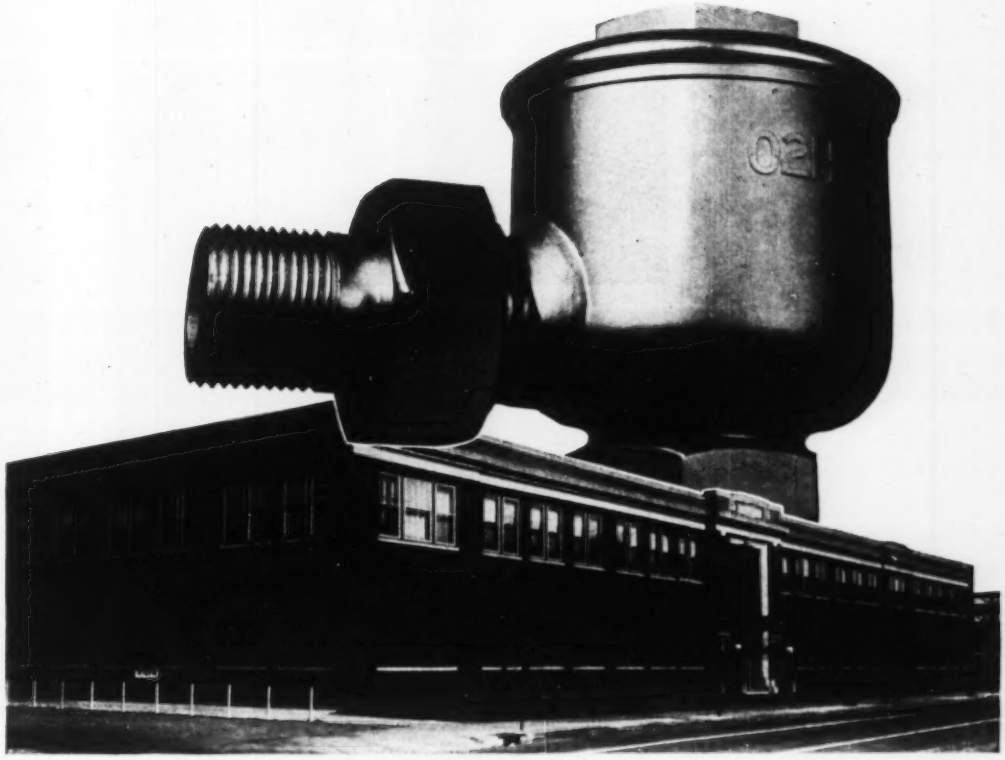
The back-scratching, in this case, was shared by the Minneapolis-Honeywell Regulator Co., which was eager to get started on its new West Coast factory, and members of the Excavating and Grading Contractors Association who were pressed for operating funds for their group.

In the spirit of an oldtime barn-raising, some 300 workers, harnessing 125 pieces of heavy equipment — bulldozers, power shovels, tractors and other heavy rigs — did the job in something under 20 working hours. Normally such a project takes from three to four weeks.

Beginning at dawn, the project was conducted with a festive air and competitive spirit. As state and city officials watched, teams operating in eight flag-marked strips pitted their skill and equipment against one another in friendly competition. Orders to the various crews were relayed through a network of 30 walkie-talkie radios, and a helicopter hovered overhead.

INCIDENTAL BENEFIT OF CHURCH AIR CONDITIONING

CAPTION FOR A CARTOON BY CHARLES CARTWRIGHT, TITLED THIS MODERN WORLD, SHOWING A MINISTER TALKING TO A MAN IN OVERALLS: "When I get to the part about hellfire and brimstone, shut off the air conditioning."



The Trap that Built a Business

No single item of the Webster line is better known to architects, engineers and heating contractors than the famous Webster Radiator Trap. More than three million of these traps were on the job in 1928 when Webster pioneered "Controlled-by-the-Weather" Steam Heating with the Webster Moderator System. The Webster Radiator Trap was a "grand daddy" in 1945 when Webster announced the development of Baseboard Heating.

Webster Radiator Traps are in service in steam-heated buildings of every type . . . saving fuel dollars . . . holding steam in radiators or steam-using equipment until it has given up all of its useful heat. Webster Traps operate continuously, providing complete, automatic discharge of air and water of condensation.

When you select Webster Radiator Traps, you get the dean of the Webster line . . . traps proved on the job for long, effective service life. Available in ½", ¾" and 1" sizes for normal operating pressures up to 15 lbs. per sq. inch. Choice of diaphragm or Sylphon Bellows types. Bulletins B-701 and B-702 sent on request.

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Designed primarily for

COMFORT

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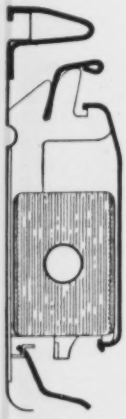
NESBITT Baseboard Radiation



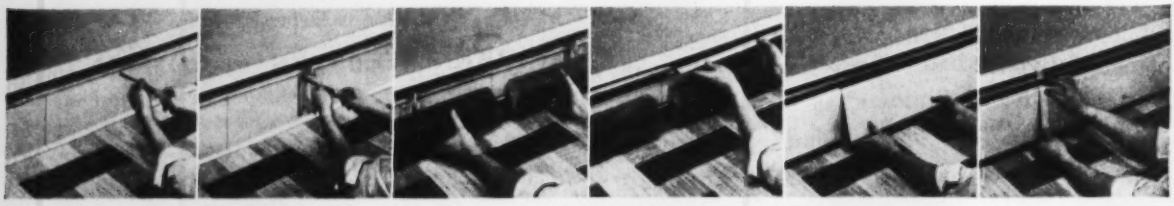
EASY TO INSTALL

PERIMETER or baseboard radiation is not a new idea . . . but Nesbitt's approach to it is. From the vantage of long experience in the field of thermal comfort, Nesbitt set out to perfect the best possible floorline convector-radiator and then to master the matter of appearance through intelligent artistry. The result is an uninhibited product—Nesbitt Baseboard Radiation—with an adequate capacity in the fin-and-tube element (4 sq. ft. per lin. ft.) to heat the average room with only one wall length—in a streamlined enclosure that fits agreeably in any decor and appeals to the modern homemaker.

Assembled, packaged lightweight units of standard lengths are available from wholesalers, with accessories and dampers as required. Ingenious helps for easy installation, including mated tube ends for jointing without fittings, save today's most expensive commodity—time. Designers and contractors who are cost-conscious, but whose better judgment dictates "wet heat," may now find their happy answer in Nesbitt Baseboard.—*Get Publication 272.*

—and to save you money

MADE BY JOHN J. NESBITT INC., PHILA. 36, PA.—SOLD EXCLUSIVELY THROUGH PLUMBING AND HEATING WHOLESALERS



1 Fasten enclosure-back to wall with screws or nails.

2 Mount the support brackets at indicated intervals.

3 Hang the assembled heating element on brackets.

4 Insert louvre blade between slots in support brackets.

5 Hang front panel on brackets, push to lock in place.

6 Attach joint trim over intersections for finishing touch.

"OPEN FOR DISCUSSION"

WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

TECHNICAL LIMITATIONS TO RESIN-WOOL FILTERS

I WAS INTERESTED in reading Howard C. Murphy's article in the April HPAC, Recent Developments in Resin-Wool Air Cleaners, and I found this information to be of general interest. However, we have been aware of all the work that Mr. Murphy reports for the last four years since the resin-wool filter, developed in Denmark and used in England and the United States, actually came into chemical warfare research work in the early 1940's.

There are many technical limitations to the resin-wool filter, most of which Mr. Murphy points out. However, I believe he is rather optimistic in hoping that there is any real large-scale commercial production or utilization in England.

When I visited the Shirley Institute in 1948 they had completed a series of tests utilizing this filter for cotton dusts and it appeared that the filter offered no appreciable improvement in performance over a plain cotton pad or an untreated wool pad. Apparently, the electrostatic charge effect in the case of cotton filters soon dissipated and the resulting performance was only comparable to that of a fine cotton filter.

For the last two years in the Harvard Air Cleaning Laboratory we have been studying electrostatic filters of several types and a report on the research on one type was given at a recent meeting of the American Industrial Hygiene Association. In this particular case we have been studying the utilization of synthetic plastic fibers which show a high dielectric and charge effect.

An extended series of investigations is also underway on a mechanically charged filter developed in this laboratory and a full description of this and its performance will be presented sometime this year.

Fundamentally, we can concur in Mr. Murphy's statements with regard to the application of the filter on radioactive work. It does not appear to be practical for this work, and for many industrial applications the filter is quite limited since it cannot perform well with heavy loadings.

One of the disadvantages of the filter apparently is that extremely high atmospheric humidity conditions causing condensation completely nullify the charge.—LESLIE SILVERMAN, Sc.D., Associate Professor of Industrial Hygiene, School of Public Health, Harvard University.

COMPARES RESIN-WOOL, POLYETHYLENE AIR CLEANERS

W. T. VAN ORMAN'S comments in the May HPAC on the resin-wool air cleaners (which I discussed in the April issue) bring out some points for discussion.

The polyethylene medium described in the paper he presented at the St. Louis meeting of the American Society of Heating and Ventilating Engineers last year appears to have a number of valuable features. However, the data given in the paper appear inadequate to establish definite efficiency ratings.

The Bureau of Standards procedure, the methylene-blue method, or some of the other test procedures would allow concrete comparisons with other constructions. Having been concerned with the testing and rating of air cleaning devices for over a quarter of a century, I am all too aware of the possibility of inaccuracies in the procedures used by Mr. Van Orman and his associates.

I attempted to secure samples of the polyethylene construction for test purposes early last year, but the test program was interrupted by my trip to Europe. However, the test results I saw in Europe on air cleaners using this material led me to believe that the resin-wool construction has entirely comparable efficiencies against fine particles.

Mr. Van Orman calls attention to the excellent paper on this subject which was presented to the meeting (in London) of the Institute of Heating and Ventilating Engineers by Dr. D. J. Thomas of the British Chemical Defense Experimental Establishment at Porton. These very complete studies were completed about two years ago and are of definite interest to anyone engaged in this field. I had the opportunity of discussing the subject of air cleaners with Dr. Thomas last August and was impressed with the excellent work he and his associates are doing.

While resin-wool air cleaners have been used, up to the present time, principally by government agencies in Europe, I found at least one English manufacturer in full-scale production and interested in commercial orders.

A resin-wool medium is also in production in the United States, being used at present (I believe) principally for gas masks.—HOWARD C. MURPHY, Consulting Engineer.

COPPER GROUND RODS PROTECT AGAINST CORROSION

WE HAVE STUDIED the paper [published in the April HPAC] entitled Fighting Underground Corrosion at the New Fairless Works, by William E. Coleman and Harold G. Frostick.

The authors have gone to extremes in avoiding any possible galvanic action between plant structures and ground rods by eliminating entirely the use of copper ground rods to drain stray currents and substituting steel rods protected from soil corrosion by magnesium anodes.

It is true that copper connected to steel and lead will cause galvanic corrosion of these latter metals, but it is also well known that the amount of galvanic corrosion depends on the relative areas of the metals involved. In a grounding system, the area of the copper ground rods is usually so small compared to the area of the buried structure or facilities that the amount of galvanic corrosion is small.

Copper ground rods are highly resistant to corrosion by widely different types of soils and do not build up a voluminous insulating coating of corrosion products. The steel ground rods will probably be effective in draining current so long as the magnesium anodes last, but would then become less and less effective as rusting progressed.—A.

W. TRACY, Assistant Metallurgist, Technical Dept., The American Brass Co.

DON'T PUT TWO VACUUM PUMPS IN SERIES

I WOULD LIKE TO comment further — supplementing my discussion in the March HPAC — on the remarks in the May issue by Samuel R. Lewis regarding the problem of returning condensate from a group of buildings.

Mr. Lewis refers, I believe, to a certain university heating system and I am somewhat familiar with that job since we furnished several vacuum heating pumps. As I remember, when the vacuum heating pumps were specified several years ago, 50 lb pressure was written into the specification. After the pumps were started and running, we received a comment that the centrifugal impellers were noisy.

We went over to see the installation and discovered that the actual discharge pressure, even though 50 lb was specified, was closer to zero and sometimes even a vacuum reading was indicated on the discharge pressure gage. We then found out that the vacuum pumps were discharging into an old vacuum return and, of course, on a centrifugal impeller when the discharge head is greatly reduced, the capacity greatly increases and will cause the pump to cavitate, causing noises in the eye of the impeller sounding like gravel flying around. This is one reason why vacuum pumps should not discharge into a vacuum return or the suction of another vacuum pump.

There is a second reason why two vacuum pumps should not be put in series. On some vacuum heating pumps, particularly those which do not use a positive shut off discharge valve, a vacuum on the discharge line of the vacuum pump can possibly siphon all of the circulating water or priming water out of the vacuum pump.

I believe, therefore, that Mr. Lewis will probably agree with me in that it is not good practice to discharge a vacuum pump into a vacuum return line. It may in some cases prove satisfactory and the tank with the float valve would probably function satisfactorily as long as the float valve performed properly.

I referred to this as a gadget and I believe that Mr. Lewis will agree with me that it really is a gadget and we do not want to put gadgets on heating systems if we can at all avoid it.

If, however, as Mr. Lewis stated, there were no funds for installing a separate discharge line from the vacuum pump to the discharge line of other vacuum pumps then this could be classed as an emergency condition or an exceptional case to the general rule.

It is important, of course, that the tank which Mr. Lewis refers to with the float valve in the bottom be vented so that the vacuum pump will be discharging into an atmospheric condition. The tank, of course, would function as a large volume storage type of trap with vacuum providing the differential across the float valve.—DICK W. WHITTINGTON, President, Whittington Pump and Engineering Corp.

HOW TO SOLDER COPPER TUBE

ALTHOUGH SOLDERED joints have been used with copper tube for a good many years, we are constantly finding from field contacts that there are many mechanics who do not properly understand the various steps necessary in making satisfactory soldered joints with copper tube. For this reason, John S. Coe's article in the May HPAC is useful and should be widely read.

I would like to make one or two suggestions, however, regarding it. Actually the first step in making a soldered joint is to cut the tube square. This operation is referred to but is not given as a numbered step, and hence might be considered of less importance than the others. The necessity for cutting the end of the tube square is to avoid pockets on the inside of the fitting which not only create turbulence, but also may create galvanic cells where corrosion may start. It also produces a good seat in the socket of the fitting and reduces the possibility of solder flowing inside the fitting.

The second step, and one that I also believe should be mandatory, is to ream the end of the tube, and remove the burrs from the tubing that may result from the cutting operation. A burr left on the inside of the tube reduces the inside diameter of the tube, and also creates turbulence. Handy tools are available that will ream the tube inside and de-burr the outside of the tube in one operation.

I would not recommend the use of what Mr. Coe refers to as "other tin-lead alloys" having a tin content of less than 50 percent for making joints where copper tube and solder joint fittings are used.

This leads us to the matter of terminology. Manufacturers share a responsibility in attempting to educate users of their products in the proper use of terms applying to them. Unfortunately common usage is not always correct, and articles such as Mr. Coe's present excellent opportunities for education.

The Welding Handbook, published by American Welding Society, clearly defines solders as distinguished from other joining media. The term "solder" should not be used for any filler metal having a melting point above 800 F. Such filler metals come under the classification of brazing alloys. This term includes what Mr. Coe refers to as "silver solders" which is a term that the manufacturers of such products do not use. According to the AWS definition the term "hard solders" should not be used for any filler metal having a melting point above 800 F.—D. L. MILLS, Research Dept., Revere Copper and Brass Inc.

BASIC EQUATIONS FOR AIR FLOW

IN THE REPORT on the industrial ventilation conference held at Michigan State College, and published in the April HPAC, basic formulas given in a paper by Jack Baliff, Senior Industrial Hygiene Engineer, State of New York Department of Labor, were printed on page 91. The velocity V should be in feet per minute, rather than in feet per second, as was shown.

This equation should read as follows:

$v = (2gh)^{\frac{1}{2}}$ or $V = 4000\ (VP)^{\frac{1}{2}}$, where V is in feet per minute and VP (velocity pressure) is in inches of water.

In the following equation, the quantity (L/D) is a ratio, and the units do not matter as long as they are the same units. This equation is as follows:

$h_f = f\ (L/D)\ (V^2/2g)$ = friction loss in closed pipe, where f = friction factor, L = length of pipe, and D = diameter of pipe.

Architect—Benjamin A. Crowther. General Contractor—Decker Construction Corporation, both of Elmira, N. Y. Heating Contractor—A. J. Eckert Company Incorporated, Albany, N. Y. Revere Dist. —LeValley-McLeod, Schenectady, N. Y.

ANOTHER CASE OF *Copper* WHERE IT COUNTS

This ultra-modern Motor Inn located just outside of Albany, N. Y., on Route 20 has all of its 100 rooms, lobby and dining room heated by radiant panel heat. Almost 24,000 feet of Revere non-rusting Copper Water Tube was used. A section of the control system is shown in photo at top right. System was designed for zone control, a most desirable feature of radiant panel heating. Note compactness and neatness of installation when you use Revere Copper Water Tube.

Now, with restrictions on copper ended, there isn't any reason why your next job can't have the many benefits of Revere Copper Water Tube for radiant panel heating, hot and cold water lines, underground service lines, processing lines, and waste stack and vent lines. See the Revere Distributor nearest you today. And, if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

REVERE

COPPER AND BRASS INCORPORATED

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Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities. Distributors Everywhere.

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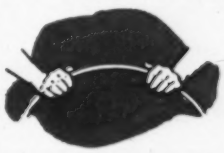
WHY REVERE COPPER WATER TUBE IS PREFERRED BY

Architects, Builders, Plumbing & Heating Contractors



EASY TO BEND

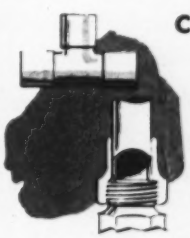
Saves Time

Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand to meet installation conditions. Hard temper by hand bending tools.

HANDY LENGTHS

Save Fittings... Labor

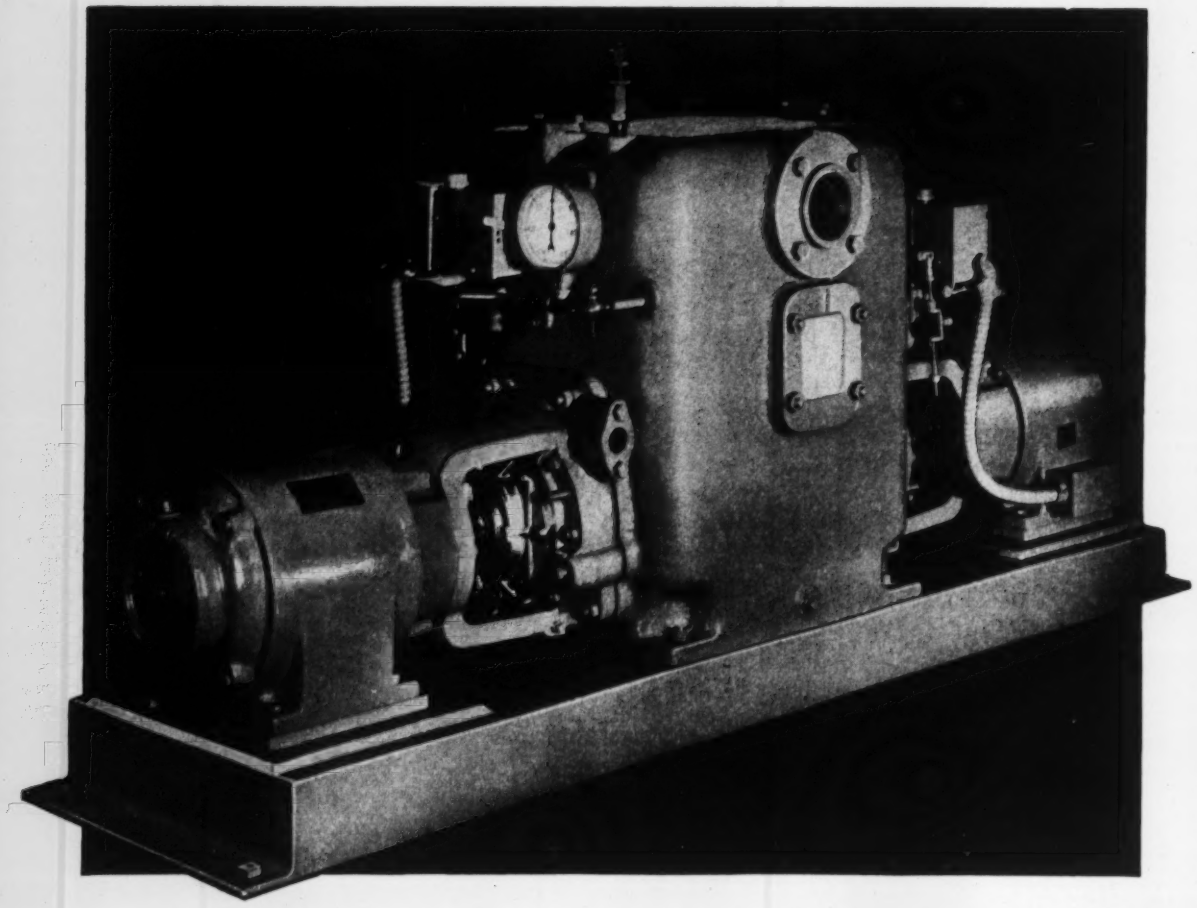
Revere Copper Water Tube comes in straight lengths of 20' in hard and soft tempers. 60' coils of soft temper reduce the number of fittings needed.



SOLDER OR COMPRESSION FITTINGS

Need Less Work Room ... Save Metal

No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.



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A Jennings Return Line Vacuum Heating Pump may be installed with the absolute assurance that it is of the proper capacity to keep your heating system at top-notch efficiency.

For the actual working capacity of your Jennings Pump is determined by careful tests under working conditions, and with the actual motor that goes on your job, regardless of current characteristics. Every Jennings Pump has to deliver full rated capacity of air and water simultaneously before it is released.

The Jennings Heating Pump has everything in the way of safety, convenience, and real dollar saving economy that years of experience as leading heating pump manufacturers have enabled us to put into it. Quality is backed by an unchallenged reputation, and satisfactory performance is assured by a nation-wide network of Sales and Service offices.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

Here's Detailed Explanation of AFI's

New Air Filter Code

By A. Nutting and R. F. Logsdon

Chief Engineer and Vice President, and Assistant Director of Research, respectively, American Air Filter Co., Inc.

The first of three sections of a new test code for air cleaning devices — covering panel or unit air filters — was recently adopted. Objectives, features and procedures of this important code, which provides a basis for the selection of filters, are discussed in this authoritative article

THE FIRST OF THREE proposed sections of a new test code for air cleaners used in general ventilation was adopted by the Air Filter Institute* at its meeting held in Chicago earlier this year. Section 1 of this code is devoted exclusively to those air filters known to the trade as "panel" or "unit" type filters. This category includes both dry type (sometimes termed strainer type) filters and viscous impingement type filters. Additional sections will be prepared to cover (a) automatic mechanical air filters; and (b) electrostatic precipitators and filters of similar class intended for removal of the discoloratıng particulate matter from ventilation air.

Objectives of Committee in Formulating the Code

In formulating the AFI code, the committee — guided by years of experience in air filter test work — set down the following points as desirable:

a) The test procedure should be as practical, direct and uncomplicated as possible.

b) The test procedure should be clearly specified, should give reproducible results, and should show a clear difference in performance between high quality and low quality filters.

All the Air Passed Through the Filter

One of the most critical aspects of previously accepted test procedures has been the sampling of only a small portion of the air and dust handled by the filter during a test. Any partial sampling procedure requires special technique if results are to be accurate and reproducible. Even with the utmost care, there is always some question regarding the accuracy of methods where only a small percentage of the total air volume is sampled.

Most partial sampling methods require the sampling of no more than 0.05 to 0.10 percent of the total air volume in question. The AFI code, as it pertains to "panel" or "unit" type filters, eliminates entirely the problems and difficulties encountered with partial sampling. This is accomplished by passing all the air through the absolute filter so that

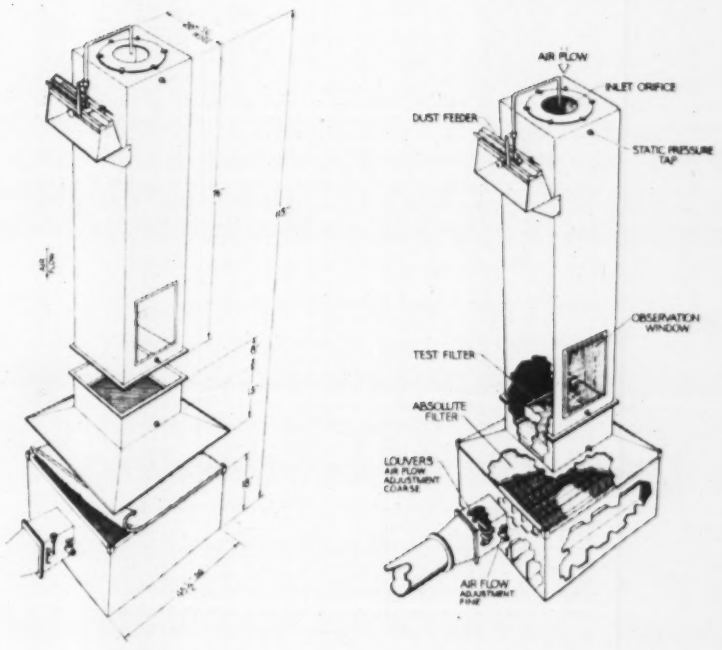


FIG. 1 — FOR TESTING UNIT TYPE FILTERS, the AFI code set-up provides for passing all the air through the absolute filter. Here are cutaway and exploded views of the vertical test duct specified in the code. An alternate horizontal arrangement is specified for those filters not recommended for vertical air flow operation

*Members of the Air Filter Institute are: Air Devices, Inc., Air Filter Corp., Air-Maze Corp., American Air Filter Co., Inc., Continental Air Filters, Inc., Dollinger Corp., Drico Industrial Corp., The Farr Co., Owens-Corning Fiberglas Corp., Research Products Corp., Trion, Inc., Wilson and Co., Inc.

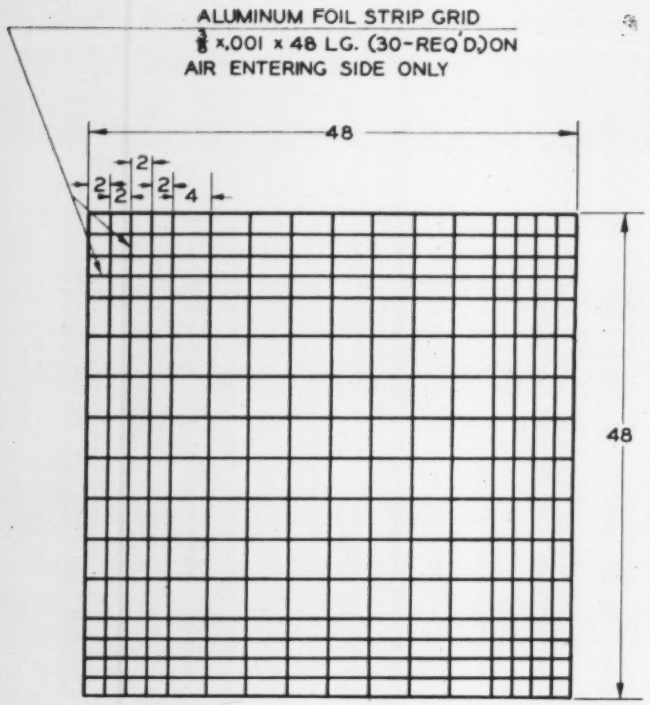


FIG. 2 — THE ABSOLUTE AIR FILTER used in the AFI code set-up has aluminum foil strips for grounding electrostatic charges. The filter is ½ in. thick fiber glass. The aluminum foil strip grid is cemented to the filter with Carter's rubber cement mixed with 50 percent benzine

all the dust passing the test filter can be collected and weighed for each efficiency determination.

This procedure also makes it possible to account directly for all the dust that has been fed into the test filter during a performance run. The code specifies that the weight of the dust collected on the absolute filter, plus the weight of dust collected in the test filter, shall equal the weight of dust fed within ±5 percent. The ability to account for all of the dust serves as proof of the integrity of the system. Partial sampling procedures cannot provide this proof, since only a very small percentage (0.05 to 0.1 percent) of the dust is recovered.

Duct Arrangement for the Test

The duct arrangement is shown in Fig. 1. Air flow is vertically downward entering through a calibrated orifice at the top end of the duct, at which point the dust mixture is injected. The air and dust are thoroughly mixed in the chamber before reaching the test filter, which is 84 in. from the inlet. The air — along with whatever dust passes the test filter — is drawn into the receiving chamber, and then to the absolute filter where the dust is removed.

How the Efficiency Is Determined

In conducting performance tests, the absolute filter is weighed before and after each dust feeding increment. The weight of dust injected into the system is known, and the efficiency for each increment of dust fed can then be determined by the following equation:

$$E = [\,1 - (Q_2/Q_1)\,] \times 100$$

where E = efficiency, percent; Q_1 = weight of dust fed; Q_2 = weight of dust collected on absolute filter.

The code clearly specifies the rate of feeding the dust and the length of time a performance test should be run. The feeding rate is 9.65 grains per 1000 cu ft of air. Efficiency runs must be made at uniform intervals, the maximum interval being 1 hr — except that in no case may less than 10 grams of dust be used for an efficiency run. The performance test is to be continued until such time as either of the following two conditions occurs:

a) Three consecutive arrestance values are less than 85 percent of the peak arrestance.

b) Resistance of the device undergoing test reaches the limit recommended by the manufacturer.

The absolute filter is specified to be no less than 99 percent efficient on the test dust and to be non-hygroscopic. [One accepted material is identified as PF105 Aerocor, ½ in. thick, ½ lb density, manufactured by Owens-Corning Fiberglas Corp.] The absolute filter is shown in Fig. 2.

The ribbons of aluminum foil are attached in order to ground the static charge collected on the surface of the material during performance tests. Failure to carry away the accumulated charge results in deposition of dust on the adjacent metal duct walls.

One of the most critical elements in air filter testing with synthetic dust is the dust dispersion apparatus. Failure to disperse the dust properly results in high efficiency values, regardless of the type of dust used. The AFI code clearly specifies the feeding equipment, the aspirator system and the feeding procedure.

Data Establishing Integrity of Method

In developing the AFI test code, one of the first tests made was to determine the quantity of dust collected on the absolute filter with the test filter omitted as compared to the quantity of dust fed. The results of four of such tests are shown in Table 1.

A second set of tests made to establish the integrity of the system determined the weight changes incurred by the absolute filter after periods of rest. Tests were made with and without test dust on the absolute filter. Table 2 shows the results of six such tests.

It may be observed in Table 2 that the greatest weight change encountered under normal laboratory conditions was 0.3 grams. This difference in weight will affect results in percentage points by

$$[(0.3)/(\text{weight of dust fed})] \times 100$$

which represents one percentage point for dust loads of 30 grams, a typical run for an 800 cfm filter.

The integrity of the method may be further illustrated by the test re-

sults on a unit type viscous impingement filter. Table 3 shows the actual test data — including the weight of the absolute filter, resistance of the test filter after each dust load and the efficiency results. Included also in Table 3 are the calculations for dust holding capacity, average arrestance or efficiency and the dust balance check. This data is shown also in Figs. 3 and 4, which are Parts I and II, respectively, of the officially approved AFI performance report.

It may be observed that the dust balance checks within 1.8 percent of the dust fed. It may also be observed that the absolute filter can be used for several arrestance or efficiency determinations. This reduces the number of weighings, as the final weight for the first run becomes the initial weight for the second run, and also tends to enhance the over-all accuracy of the procedure, as any errors made in weighing or recording weights for one run are compensated for in the subsequent run.

Uniform Reporting of Results

One of the important aims of the AFI code is to specify reporting procedures in such a manner that performance results for similar classes of filters are reported in a uniform manner. Fig. 5 is a facsimile of Report Form AFI 540, but including in addition instructions for the use of this form. Fig. 3 shows Form 540 properly filled out in accordance with the instructions provided in Fig. 5. Instructions for filling out Part II of the official report are shown in Fig. 6. The properly filled out form is shown in Fig. 4.

The AFI code places as much emphasis on dust holding capacity, which represents filter life, as it does on arrestance or efficiency. The manner in which dust holding capacity is determined is specified in the code and is listed in tabular form on the performance report.

Provides Basis for Selecting Air Filters

Section I of the AFI code specifies testing equipment, testing procedure and reporting methods of such a nature that the following accomplishments are realized:

a) Means are provided for comparison of arrestance of air filters of the "panel" or "unit" type. The method of reporting makes it possible to compare arrestance at various stages in the life of the filter in question.

b) Rigid specifications are provided for establishing dust holding capacity values, from which values filter life may be estimated.

c) Means are provided for comparison of resistance of various filters at various rates of air flow.

d) Finally, through the above Items (a), (b) and (c) a basis for selection of air filters is provided.

Items (a) and (b) above merit further explanation. With reference to the comparison of arrestance, it should be pointed out that the test dust mixture chosen for performance tests is sufficiently severe to give a wide spread in efficiency values between a known high quality filter and one that is known to be of low quality. This choice was a deliberate one, for it is one of the aims of the code to show a clear and distinct difference in air filters having different collectance characteristics. For example, one type of filter of known and accepted high performance characteristics on ventilating air has an efficiency value by the AFI test in the order of 90 percent. At the other end of the scale, commercially available air filters of recognized low quality yield arrestance values as low as 50 to 60 percent.

With reference to judging the life of air filters from performance reports, it is again important to realize that the dust chosen for the performance tests is one that has air filter plugging characteristics not unlike atmospheric dust that exists in urban and industrial areas. *Selection of a test dust for efficiency determinations only is not sufficient, as efficiency is by no means the only factor in evaluating performance.* Loading characteristics of the filter are of equal importance — and these

TABLE 1—DUST RECOVERY ON ABSOLUTE FILTER with test filter omitted

Dust fed, grams	Weight of absolute filter, grams		Weight increase of absolute filter, grams	Percent dust recovery
	Initial	Final		
20	185.9	204.0	20.1	100.5
20	195.0	215.5	20.5	101.5
20	189.4	209.3	19.9	99.1
20	215.3	235.5	20.2	101.0

TABLE 2—WEIGHT CHANGE OF ABSOLUTE FILTER after rest periods and after passage of room air

Test No.	Condition of absolute filter	Treatment of absolute filter	Change in weight of absolute filter, grams
1	Loaded with 60 gm AFI dust	At rest overnight in laboratory	+0.5
2	Clean	At rest overnight in laboratory	±0.0
3	Loaded with 80 gm AFI dust	At rest over night in laboratory	±0.0
4	Loaded with 20 gm AFI dust	At rest overnight in laboratory	+0.1
5	Clean	Subjected to 800 cfm air flow, room air, for 20 minutes	+0.1
6	Clean	Subjected to 800 cfm air flow, room air, for 5 minutes	−0.1

TABLE 3—AFI TEST on Filter "X"

Dust fed, grams	Cumulative dust fed, grams	Test filter resistance, in. WG	Absolute filter weight		Dust on absolute filter, grams	Efficiency, percent
			Start	End		
0	0	0.045	——	——	0.0	——
30	30	0.050	199.0	209.8	10.8	64.0
30	60	0.070	209.8	220.2	10.4	65.3
30	90	0.090	194.6	204.4	9.8	67.4
30	120	0.105	204.4	214.1	9.7	67.7
30	150	0.120	214.1	223.1	9.0	70.0
30	180	0.145	185.0	193.1	8.1	73.0
30	210	0.185	193.1	200.8	7.7	74.0
30	240	0.230	200.8	208.4	7.6	74.7
30	270	0.330	190.0	197.0	7.0	76.6
30	300	0.415	197.0	204.2	7.2	76.0
30	330	0.510	204.2	211.0	6.8	77.3

Average efficiency: 71.5 percent.
Total dust fed: 330 grams.
Dust fed to 0.5 in. WG: 326 grams.
Dust holding capacity to 0.5 in. W.G.: 326 × 0.715 = 233.1 grams.
Final weight of filter: 5230 grams.
Initial weight of oiled filter: 5000 grams.
Weight increase of filter: 230 grams.
Dust collected on absolute filter: 94.1 grams.
Total dust recovered: 324.1 grams.
Dust balance = (−5.9/330) × 100 = −1.8 percent.

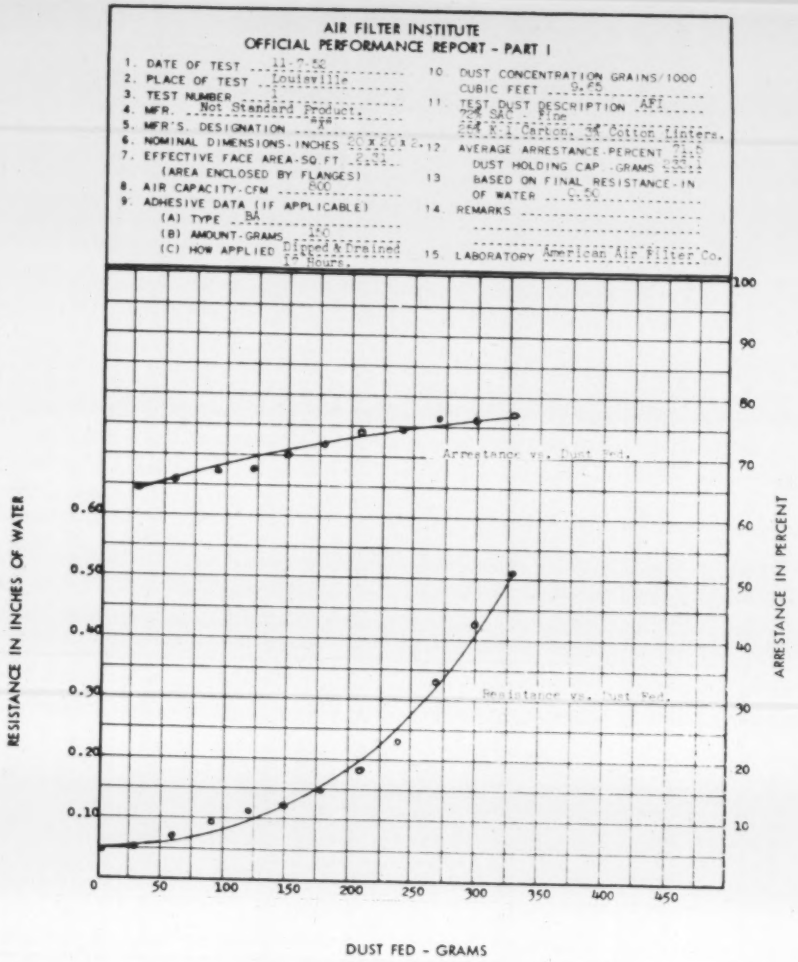

AIR FILTER INSTITUTE
OFFICIAL PERFORMANCE REPORT - PART I
1. DATE OF TEST 11-7-56
2. PLACE OF TEST Louisville
3. TEST NUMBER 1
4. MFR. Not Standard Product
5. MFR'S. DESIGNATION "X"
6. NOMINAL DIMENSIONS-INCHES 20" X 20" X 2"
7. EFFECTIVE FACE AREA-SQ.FT. 2.5
(AREA ENCLOSED BY FLANGES)
8. AIR CAPACITY-CFM 500
9. ADHESIVE DATA (IF APPLICABLE)
(A) TYPE BA
(B) AMOUNT-GRAMS 450
(C) HOW APPLIED Dipped & Drained 24 Hours.
10. DUST CONCENTRATION GRAINS/1000 CUBIC FEET 9.45
11. TEST DUST DESCRIPTION AFI 70% SAE - Fine 30% Carbon, 50 Cotton Linters.
12. AVERAGE ARRESTANCE-PERCENT 81.5
DUST HOLDING CAP.-GRAMS 1221
13. BASED ON FINAL RESISTANCE-IN OF WATER 0.50
14. REMARKS
15. LABORATORY American Air Filter Co.
Arrestance vs. Dust Fed.
Resistance vs. Dust Fed.
RESISTANCE IN INCHES OF WATER
ARRESTANCE IN PERCENT
DUST FED - GRAMS

FIG. 3 — PERFORMANCE CURVES AND DATA for test on viscous impingement filter. This report is based on instructions given in Fig. 5, which is taken from the code

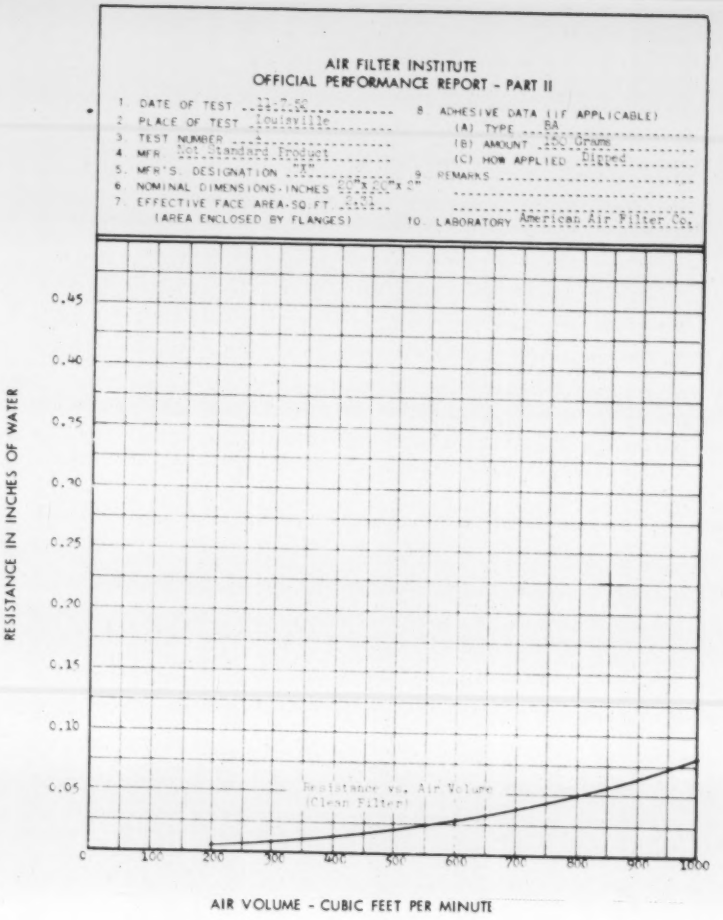

AIR FILTER INSTITUTE
OFFICIAL PERFORMANCE REPORT - PART II
1. DATE OF TEST 11-7-56
2. PLACE OF TEST Louisville
3. TEST NUMBER 1
4. MFR. Not Standard Product
5. MFR'S. DESIGNATION "X"
6. NOMINAL DIMENSIONS-INCHES 20" X 20" X 2"
7. EFFECTIVE FACE AREA-SQ.FT. 2.5
(AREA ENCLOSED BY FLANGES)
8. ADHESIVE DATA (IF APPLICABLE)
(A) TYPE BA
(B) AMOUNT 450 Grams
(C) HOW APPLIED Dipped
9. REMARKS
10. LABORATORY American Air Filter Co.
Resistance vs. Air Volume (Clean Filter)
RESISTANCE IN INCHES OF WATER
AIR VOLUME - CUBIC FEET PER MINUTE

FIG. 4 — PART II OF PERFORMANCE REPORT on Filter "X" showing resistance plotted against air volume. This report is made in accordance with instructions given in Fig. 6

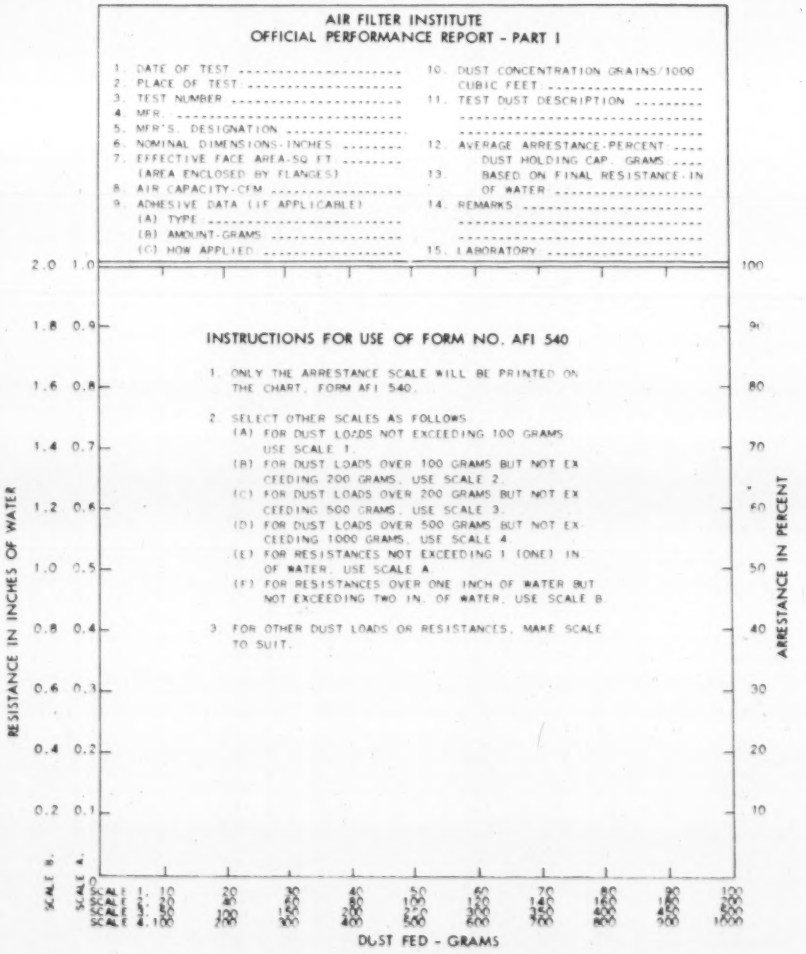

AIR FILTER INSTITUTE
OFFICIAL PERFORMANCE REPORT - PART I
1. DATE OF TEST
2. PLACE OF TEST
3. TEST NUMBER
4. MFR.
5. MFR'S. DESIGNATION
6. NOMINAL DIMENSIONS-INCHES
7. EFFECTIVE FACE AREA-SQ. FT. (AREA ENCLOSED BY FLANGES)
8. AIR CAPACITY-CFM
9. ADHESIVE DATA (IF APPLICABLE) (A) TYPE (B) AMOUNT-GRAMS (C) HOW APPLIED
10. DUST CONCENTRATION GRAINS/1000 CUBIC FEET
11. TEST DUST DESCRIPTION
12. AVERAGE ARRESTANCE-PERCENT
DUST HOLDING CAP. GRAMS
13. BASED ON FINAL RESISTANCE-IN OF WATER
14. REMARKS
15. LABORATORY
INSTRUCTIONS FOR USE OF FORM NO. AFI 540
1. ONLY THE ARRESTANCE SCALE WILL BE PRINTED ON THE CHART, FORM AFI 540.
2. SELECT OTHER SCALES AS FOLLOWS
(A) FOR DUST LOADS NOT EXCEEDING 100 GRAMS USE SCALE 1.
(B) FOR DUST LOADS OVER 100 GRAMS BUT NOT EXCEEDING 200 GRAMS, USE SCALE 2.
(C) FOR DUST LOADS OVER 200 GRAMS BUT NOT EXCEEDING 500 GRAMS, USE SCALE 3.
(D) FOR DUST LOADS OVER 500 GRAMS BUT NOT EXCEEDING 1000 GRAMS, USE SCALE 4.
(E) FOR RESISTANCES NOT EXCEEDING 1 (ONE) IN. OF WATER, USE SCALE A.
(F) FOR RESISTANCES OVER ONE INCH OF WATER BUT NOT EXCEEDING TWO IN. OF WATER, USE SCALE B.
3. FOR OTHER DUST LOADS OR RESISTANCES, MAKE SCALE TO SUIT.
RESISTANCE IN INCHES OF WATER
SCALE B.
SCALE A.
ARRESTANCE IN PERCENT
DUST FED - GRAMS

FIG. 5 — INSTRUCTIONS for preparing Part I of performance report

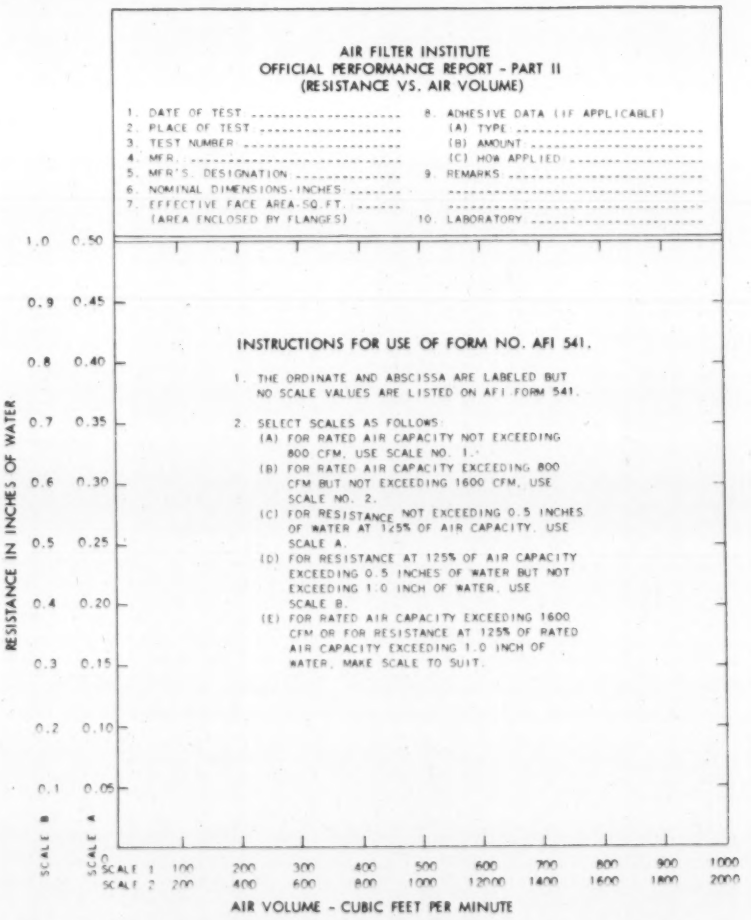

AIR FILTER INSTITUTE
OFFICIAL PERFORMANCE REPORT - PART II
(RESISTANCE VS. AIR VOLUME)
1. DATE OF TEST
2. PLACE OF TEST
3. TEST NUMBER
4. MFR.
5. MFR'S. DESIGNATION
6. NOMINAL DIMENSIONS-INCHES
7. EFFECTIVE FACE AREA-SQ.FT. (AREA ENCLOSED BY FLANGES)
8. ADHESIVE DATA (IF APPLICABLE) (A) TYPE (B) AMOUNT (C) HOW APPLIED
9. REMARKS
10. LABORATORY
INSTRUCTIONS FOR USE OF FORM NO. AFI 541.
1. THE ORDINATE AND ABSCISSA ARE LABELED BUT NO SCALE VALUES ARE LISTED ON AFI FORM 541.
2. SELECT SCALES AS FOLLOWS:
(A) FOR RATED AIR CAPACITY NOT EXCEEDING 800 CFM, USE SCALE NO. 1.
(B) FOR RATED AIR CAPACITY EXCEEDING 800 CFM BUT NOT EXCEEDING 1600 CFM, USE SCALE NO. 2.
(C) FOR RESISTANCE NOT EXCEEDING 0.5 INCHES OF WATER AT 125% OF AIR CAPACITY, USE SCALE A.
(D) FOR RESISTANCE AT 125% OF AIR CAPACITY EXCEEDING 0.5 INCHES OF WATER BUT NOT EXCEEDING 1.0 INCH OF WATER, USE SCALE B.
(E) FOR RATED AIR CAPACITY EXCEEDING 1600 CFM OR FOR RESISTANCE AT 125% OF RATED AIR CAPACITY EXCEEDING 1.0 INCH OF WATER, MAKE SCALE TO SUIT.
RESISTANCE IN INCHES OF WATER
SCALE B
SCALE A
SCALE 1
SCALE 2
AIR VOLUME - CUBIC FEET PER MINUTE

FIG. 6 — INSTRUCTIONS for preparing Part II of performance report. Part II shows only the relationship between resistance and air volume for the clean filter

are mainly dependent upon the bulk density of the dust rather than on particle size.

The Test Dust — and Why It's Used

The test dust mixture consists of 72 percent standardized air cleaner test dust, fine (Arizona road dust, fine); 25 percent K-1 carbon black; and 3 percent No. 7 cotton linters. (Percentages by weight).

The standardized air cleaner test dust was developed for testing air cleaners used on engine air intakes. This dust is collected from Arizona fields, and is prepared and classified by the AC Spark Plug Div. of General Motors. This dust has wide acceptance for the testing of engine air cleaners, being specified by the Society of Automotive Engineers and by the various branches of the military dealing with tests on air cleaners for engines. As one of the ingredients of AFI test dust, it might be considered as representing the inorganic, non-combustible matter in the atmosphere. It is not, however, representative of atmospheric dust in its plugging characteristics. But it is a desirable ingredient of the test dust in that it is commercially available, is reproducible and is easily dispersed.

The carbon represents the free carbon existing in the atmosphere, is one of the most damaging materials in ventilating air supplies and is one that it is most important to remove.

The lint is representative of the organic material, other than free carbon, in the atmospheric air and is representative especially of the linty material found in returned air from ventilated areas. This material tends to clog the air filter passages more readily than the others and therefore tends to reduce dust holding capacity values — especially for viscous impingement type air filters.

Taken alone, not any of these three dust components has the required characteristics of a good test dust for ventilation filters. The standardized air cleaner test dust yields unrealistically high dust holding capacity values; carbon black contributes to lower arrestance values but is difficult to disperse alone; lint is too easily arrested and clogs filters too rapidly to be a single test dust ingredient.

The mixture, taken together, is an excellent synthetic dust for air filter performance tests for it is readily dispersed with the equipment specified, gives wide spreads in efficiency values and gives realistic values for dust holding capacity.

CONFER ON ANTHRACITE AT LEHIGH

SMOKE CONTINUES to be the first and most important source of air pollution in most cities, Dr. Louis C. McCabe, chief of the fuels and explosives division of the U.S. Bureau of Mines, told more than 200 delegates attending the opening session of the 11th anthracite conference held at Lehigh University last month.

"The interest in the complex chemical and metallurgical air pollution problems calls attention to the necessity for smoke abatement wherever it exists," he said. "In almost every instance, whatever the cause of air pollution, smoke abatement is the first effort of enforcement officials. Success in this phase of the problem is rather dramatic. If the cost of attaining it is not too great a burden on the consumer, it is attained without the necessity of extensive research."

L. C. Dubs, president of the Canton Stoker Corp., urged that the anthracite industry enter into a cooperative arrangement with stoker and equipment manufacturers "to speed up the development of burning, handling and control equipment, so that coal may regain its rightful place in the national fuel burning picture and promote the development of one of our greatest national resources."

New developments in grates were described by Henry K. Eilers, Pyramid Grate Co. He said that new equipment "retains all of the advantages of cleanliness and low cost with more efficient utilization of fuel and a lengthening out of the firing interval."

When the supply of natural gas declines, the manufacture of high-Btu gas from coal will become commercially feasible, L. L. Newman, gas engineer of the fuels and explosives division of the U.S. Bureau of Mines, told the conference.

Alan G. Mayer, Toker Coal Co., in discussing stoker sales, said that "the producers must take every step possible to see that coal can be sold at a reasonable price. The industry as a unit should provide engineering assistance to dealers anxious to hold commercial type accounts."

Although the sale of stokers and stoker-boiler units is of first importance, "the care and servicing of equipment should not be looked upon as just a necessary evil", Tusten Van Duzer, Motor Stokor Sales Co., said. "Prompt and efficient service of heating equipment is of vital importance to sales," he stated.

In order to hold its present markets and expand by creating new ones, the anthracite industry must furnish a product of the highest quality, David B. Baird told the delegates. "In view of the fact that the anthracite industry is facing a buyer's market, the subject of quality control and inspection is of utmost importance to the public," he said. "Coal, like most other commodities, is sold on a basis of comparison. On this basis of comparison, reputations are won and lost. On the superiority of its product one concern thrives and expands, while another, due to inferiority of quality, faces a narrowing market and ultimate failure."

Open curing of bright leaf tobacco with anthracite "offers the advantages of extreme fuel economy, shorter curing periods and upgrading of the leaf," said Paul F. White, of the Anthracite Institute. He discussed field experiments during the past year.

David J. Crawford, mining research engineer, Lehigh Navigation Coal Co., reported on a mining research program for the industry. He said, "costs for labor and material have been increasing, whereas the productivity per employee has been relatively constant. As a result, the price of a ton of anthracite has been progressively increasing."

Kenneth E. Sanger reported on engineering studies to develop ways and means of increasing the efficiency of the combustion of fuels. "In order to realize and maintain economies," he said, "there is need for independent engineering supervision bureaus which will act as consulting engineers for municipal plants."

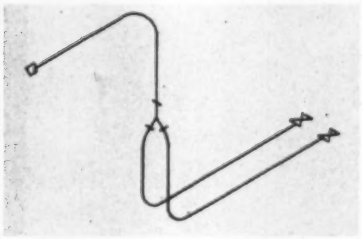


FIG. 1 — SIMPLEST division of the steam line is a wye connection

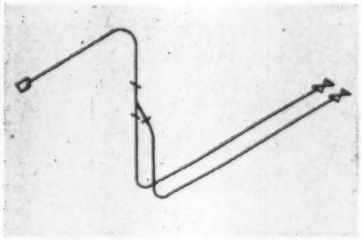


FIG. 2 — THIS IS A LATERAL TYPE WYE connection. A true wye is shown in Fig. 1

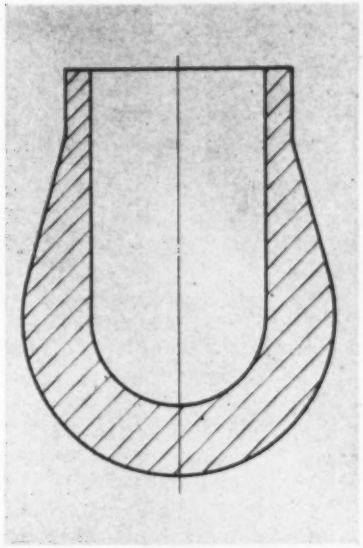


FIG. 3 — "TEAR-DROP" forging went far toward solving the problem. Extra thickness of metal compensates for loss of material removed in cutting for the nozzle welding of the adjacent pipe bends

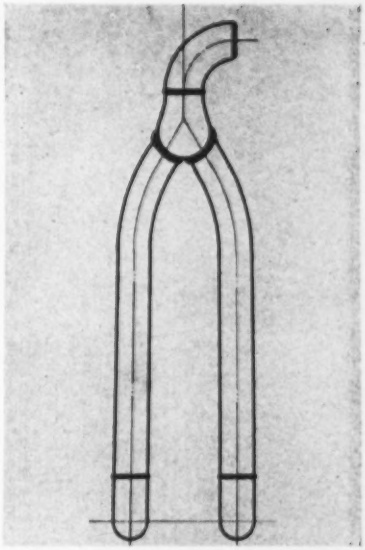


FIG. 4 — COMPLETE ASSEMBLY comprises two pipe bends welded to the forging shown in Fig. 3. An alloy assembly like this is readily fabricated in a modern shop

Dual Steam Inlets on Turbines

. . . . pose a piping problem

By W. H. Goetz
Engineer, Crane Co.

LARGE CAPACITY steam turbines designed for high pressure-high temperature service in power plants are being equipped with dual steam inlets instead of the customary single inlet. This poses some problems.

With dual steam inlets, the large main steam lead must be divided into two smaller leads. The flexibility of this piping and correct stress allowances must be considered. At the same time, the design should incorporate simplicity in the piping layout, keep its cost to a minimum, and yet fulfill all intents of the design contemplated by the engineer. That's the essence of the problem.

The division of the steam line can be accomplished in several ways. The simplest is a wye connection — either a true wye per Fig. 1 or a lateral type as sketched in Fig. 2. Such wye fittings would be designed with beveled ends for welding to adjacent piping and, to conform with present-day practice, should be made of chrome-molybdenum alloy steel.

These wye fittings could be special castings, but current practice favors the use of special forgings. The relative weights of castings and forgings also affect calculations when laying out the piping and its supports.

In the search for a practical and economical solution — but still utilizing a forging and welded piping joints — a tear-drop suggested itself as the right type of forging and went far toward solving the problem. Fig. 3 shows a cross section of this forging. It is easy to form and machine. Its spherical shape permits adequate distribution of metal throughout, making it structurally strong, while weight can be kept to a minimum.

Such a forging can be designed and the specifications for it so written that it will suit the pressure and temperature conditions of the installation, and will also comply with applicable codes. Radiographic or magnetic particle inspection (both inside and outside after machining) can be used to insure sound metal throughout the forging.

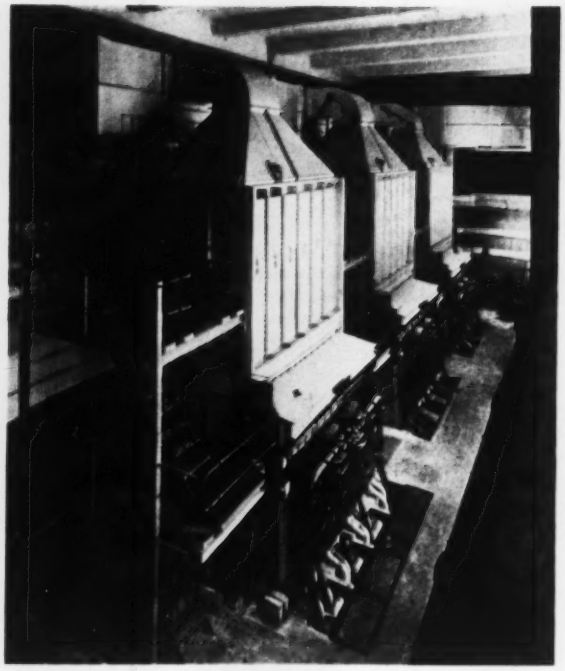
One other detail was part of the solution to the problem. Two pipe bends were to be welded to the forged true wye, per Fig. 4. Fig. 3 shows how extra thickness of metal was added to the wye in order to compensate for the loss due to the material removed in cutting for the nozzle welding of the adjacent pipe bends. Thus, the need for reinforcement of the nozzle welds by means of rings or saddles was eliminated. The resultant design also achieves an added advantage of compactness.

The welding of high pressure-high temperature chrome-moly alloy piping presents no particular problems today, when adequate welding skills and attendant know-how and facilities are available. An alloy assembly like the one shown in Fig. 4 lends itself to fabrication in any modern shop where facilities are available for setup, proper alignments, full furnace stress relieving, radiography of welded joints, hydrostatic testing — plus adequate final cleaning by pickling and the sandblasting of the interior surfaces.

The size of such assemblies is determined by shipping facilities and the extent to which the shape and weight permit safe handling in erection in the field.

The assembly described above solved what — at the start — was a perplexing problem.

MODEL OF THE ABBEY and annex, showing the nine "Queen's Beasts". Air inlet to annex is behind them



BOILER HOUSE for Whitehall district heating scheme, showing forced circulation HPHW boilers

A "Heating Engineer's View" of the Coronation

[Just about every other magazine published in the U.S. has been full of features on the coronation of Queen Elizabeth. We asked our correspondent in London to write something on the heating and air conditioning of the buildings involved — in one way or another — in the elaborate ceremonies.]

A BUSY PLACE before London existed, Westminster and Whitehall have been the center of Britain's power for centuries. For 900 years, the coronation of her kings and queens has taken place at Westminster; first in the great church built by Edward the Confessor, and then, since the 13th century, in the present Abbey built on the same site by Henry III. The coronation ceremony itself has changed little for nearly 1200 years.

On the processional route to and from the Abbey are many buildings, some old and some new, of interest to the heating and ventilating engineer for the manner by which they are warmed or air conditioned.

As the procession passed along Victoria Embankment, reserved for children spectators on that day, Queen Elizabeth may have glanced across the Thames to the Royal Festival Hall — the recently completed concert hall — where a 36 million Btu per hr battery of boilers forms part of one of the largest gas fired installations in England. Because of its size and the relatively high cost of gas, the capital cost of an economizer, raising the efficiency to 85 percent, has been considered worthwhile. Although the complete design allows for an extension to full air conditioning, a decision to install a refrigerating plant has been deferred. In the meantime, an experimental heat pump is in operation, based on a gas fired internal combustion engine and water from the Thames as the heat source.

For the first time, special precautions were taken to assure adequate ventilation both in the Abbey and the temporary annex.

Theoretically a simple problem, there were a number of practical difficulties — one being that the Abbey authorities forebade the use of any part of the structure for solid attachment of equipment. The people present inside the building were accommodated in three tiers of seats. The necessity to provide air movement and air change between the tiers was obvious.

On this occasion there were additional heat gains from the electrical apparatus and lighting associated with television, filming and broadcasting. For a period of 4 hr, the probable number of people in the Abbey was 7500 and the extra electrical load was 200 kw. Allowing for the large volume of the Abbey — a total of about 3 million cu ft — and the

immense heat capacity of the structure, it was estimated that the consequent temperature rise in the comparatively short time involved would not create unreasonable discomfort.

The main objective was to assure equable air distribution, which was achieved by mechanical exhaust with natural air inlets. Seven 36 in. diameter propeller fans were installed at high level, exhausting direct to the outside. Their actual positions were determined mainly by the practicability of installing them. For instance, some were fixed in doorway openings after doors had been carefully removed. Natural planned air inlets made use of doorway openings and existing staircases, running from floor to roof and serving intermediate positions. A marked plan was used to indicate the doors required to be shut or fixed open.

Temporary lavatory accommodations within the Abbey were ventilated by independent 12 in. propeller fans. Recirculating fans were fixed at points such as camera positions, where heat gains were locally high.

The annex, a temporary building of about 200,000 cu ft at the west door of the Abbey, gave facilities for the Royal Family and attendants for assembly and refreshment. It contained the royal suite, reception hall, peers' hall, kitchen and refreshment room. With the exception of the royal suite, which had independent direct natural air inlet from atmosphere, all air for this building entered by the west face about 3 ft from ground level, and was exhausted, with mechanical assistance from propeller fans, through voids formed in the ceiling structure.

The Abbey is warmed in winter by an aging system of hot water pipe coils and radiators and hand fired boilers. But on the other side of Parliament Square the new chamber of the House of Commons has a modern air conditioning plant, with automatic reversal of air movement across the chamber to promote a sensation of freshness.

Most of the buildings in present-day Whitehall are of the last three centuries. Yet the very old still jostles the very new. Behind the Banqueting Hall — the Inigo Jones masterpiece — rises the modern government building in Whitehall Gardens. While perhaps reminding us that Whitehall is still the administrative heart of government in England, this fine new building, with a proper reverence for the past, embraces and preserves within its very walls one of the few remains of the old Tudor palace of Whitehall and some of the beautiful, priceless Adam ceilings and Grinling Gibbons carvings saved by the Ministry of Works from the old houses originally on the site.

The Whitehall Gardens building is but a part of a long-term plan conceived in broad terms before the 1914-18 war. On completion, the 10 story building will accommodate about 6000 personnel and its boiler chamber will eventually house high pressure hot water boilers, fired by creosote pitch, with a total output of 140 million Btu per hr, sufficient to supply a district heating system serving most of the government buildings in Whitehall. At about the boiler house ceiling level and not far from the boiler house itself, Henry VIII's wine cellar has found its new home. The HPHW mains which supply the district heating system pass close by. Here indeed is a striking contrast of old and new in close proximity. Before the war, Parliament was given an undertaking that this fine remnant of the old Whitehall palace would not be destroyed. Unfortunately its position interfered with both plan and elevation of the new building. It was near ground level. The contractors skillfully moved the whole 100 tons of it *en bloc*. It is now 10 ft below ground level.

Some of the buildings in Whitehall are already connected to the district system. In general, existing central heating boilers have been replaced by calorifiers, (heat exchangers). The War Office was originally heated by 350 radiators and 165 open coal fires!

Fully Air Conditioned Picture Gallery

On the far side of Trafalgar Square, through which the coronation procession passed twice, lie the National Gallery and the National Portrait Gallery, both of which are warmed by a 60 year old forced circulation hot water radiator system from hand fired solid fuel boilers. The west wing of the National Gallery was badly damaged by a bomb during the war and a portion of it has since been rebuilt, with full air conditioning. Gallery XXIX at the National Gallery is one of the few fully air conditioned picture galleries in Europe. The main and preheater batteries take heat, with suitable control gear, from the original boiler house; but marginal differences in loads due to exposure and occupancy are taken up by individual electric heater batteries in the supply ducts. Priceless paintings, such as da Vinci's "Madonna of the Rocks", some of them rarely on view to the public because of the dangers due to humidity variation and the London atmosphere, are now hung, unglazed, in that gallery.

Soon after the procession left Pall Mall, the home of a number of famous London clubs, it passed from St. James's St. into Piccadilly, where the extent to which a large London hotel is prepared to go to attract the overseas visitor is well illustrated by its new and fully air conditioned American bar. The heat source is electricity.

The hotel industry in Britain now realizes that a perfect cuisine and a high level of service in other directions will never make up for deficient heating and ventilation. In Park Lane, the Dorchester and the Grosvenor stand witness to this fact.

On towards Buckingham palace, the procession continued past the big stores of Oxford St. and Regent St. across Piccadilly Circus into Haymarket and theaterland. Leslie Henson referred to the Carlton theater (now a cinema) in his book of reminiscences "Yours Faithfully". He wrote "The latest ventilation system was installed . . . . with dynamos on the roof, and we were promised this would take the London air, collect it, drive it through water and blankets, hot or cold according to the weather, and distribute it pure and undefiled to the audience. . . . .It was difficult to get to the theater that night, as there certainly was a bit of a fog, but as I made my entrance with a bound on to the stage to greet Laddie and Cyril Ritchard I was astonished to find that I could hardly see them in the all-pervading gloom. . . . .I became hysterical and when I did find Laddie I whispered 'the ventilation machine is in reverse'. It seemed to me that it was sucking in fog and packing it tight in the theater". But that was in 1927.

PASSENGERS ON THE SANTA FE see this view of the new plant and office buildings as they cross the Mississippi at Fort Madison

AIR CONDITIONING UNITS in C. R. Sheaffer's corner office are flush in the exterior walls. They allow individual control of comfort

PARTITIONS OPEN AT THE TOP allow for increased air conditioning and lighting efficiency in this office area on the second floor

The Right Thing To Do

Sheaffer Pen Air Conditions

IN THE W. A. SHEAFFER PEN CO.'s new $3¼ million manufacturing and office buildings — overlooking the Mississippi at Fort Madison, Iowa — air conditioning affords independence from excessive temperature and humidity.

The new three story manufacturing building provides 165,000 sq ft for the precision manufacture of Sheaffer pens and pencils. The new office building — four stories high, with a total of 40,000 sq ft — is adjacent. Practically all the air handling equipment for air conditioning and process exhaust is centrally located in two penthouses on the manufacturing building, to minimize installation costs. Maintenance is also thus simplified.

Steam for heating and process is furnished by two 150 hp horizontal return tube boilers. They were used for heating the old manufacturing building, known as plant No. 1, and were housed in a boiler room on the east side of plant No. 1. The west end of the new manufacturing building overlapped the boiler location, so the boilers were not moved from their original setting but were completely housed in the new building.

To reduce maintenance and operating costs, the boilers were converted from 100 lb operating pressure to 15 lb. They were also converted to combination gas and oil firing.

A total of 186,000 cfm of air is supplied the manufacturing building to change the air once every 10 minutes; of this total, 125,000 cfm is taken from outdoors to provide ventilation air, make-up for exhaust from grinding, polishing, buffing and plating, and to pressurize the building in order to reduce infiltration of heat, cold and dust.

The air is distributed by means of six built-up and six package type air conditioning supply units through ductwork to the various zones, and introduced into the space through ceiling diffusers. The distribution system is zoned according to departments, usage of space and exposure — resulting in 25 zones of temperature control.

Each system provides for tempering outside air, filtering all air, cooling and dehumidification by means of a combination of well water and chilled water coils, humidification by means of steam grid type humidifiers, and final temperature control using forced hot water zone reheat coils.

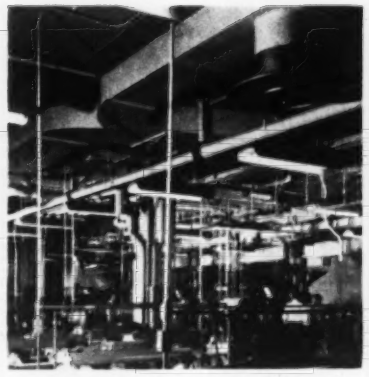
Perimeter heating of the building is accomplished with finned tube forced hot water radiation below window sills.

Closely allied with the air conditioning of the manufacturing building is the efficient and thorough removal of dust, dirt, refuse, fumes, vapors, gases and mists at their sources, and their disposal at suitable locations where they can do no harm.

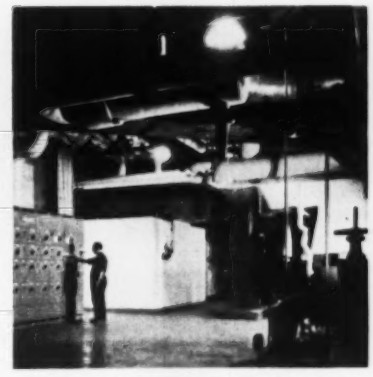
This is accomplished by exhausting 85,000 cfm of air by means of 23 exhaust systems. The cyclone dust collectors are placed on the roof in such a manner as to take advantage of architectural features which provide natural concealment, and away from other ventilating openings to eliminate contamination of air introduced into the buildings.

The air conditioning installation for the office building features a high pressure conduit system with induction convectors serving the exterior offices, and a low pressure duct system with induction convectors for interior offices.

The air cycle of the main apparatus, which treats the primary air for both systems, consists of an automatic oil filter, steam-distributing-tube preheater and reheater coils, chilled water coils, and a steam grid humidifier. Also in the air cycle is a fan handling return air from corridors. The primary air fans for both the high and low pressure systems draw their air from the main apparatus. During cooling all dehumidification for the building is carried out in the main apparatus; thus, the



THE PLASTIC MOLDING DEPARTMENT turns out thousands of different pieces for fountain pen and pencil barrels, caps and parts



AIR HANDLING EQUIPMENT is installed in two penthouses on the manufacturing building. Pumps along the wall deliver hot water for heating

ROOF SPRAYS using 200 gpm of water wasted from the air conditioning installation furnish the cooling equivalent of 33 tons of refrigeration

primary air circulated to the room units has the ability to pick up the moisture released in the room.

The fan for the high pressure conduit system delivers 5500 cfm at 6½ in. static pressure through conduits at velocities of 2500 to 3000 fpm. A sound absorber header is provided at the fan outlet. The air is distributed through horizontal conduit headers above the fourth floor ceiling, and parallel to the outside walls of the building. Extending from the main headers are smaller vertical headers which drop into furred spaces along the column lines. The final connections to the room units are made by means of 3 in. flexible run-outs.

Sixty-two room units for the high pressure system are located under the windows, combining the air distribution system with the heating and cooling system. These units are furred into the wall construction, and introduce air into the room through grilles in the window stools.

Primary air enters the bottom of the unit through nozzles which produce a high velocity air jet. The jet induces a flow of air from the room through coils in the secondary air stream, and by aspiration, the final volume of conditioned air supplied to the room amounts to four times the volume of primary air.

The coil in the secondary air stream is supplied with 50 deg water in summer and 160 deg water in winter. The primary air has capacity to absorb the latent heat gain in summer, and has sufficient moisture during winter to humidify. The primary air is also sufficient for ventilation. It is supplied at a constant 50 deg temperature during winter, and heat is added by means of the coil in the secondary air stream as dictated by the individual room control. This provides a source of cooling which is often required even though the outdoor temperature is below 50 deg.

At the change-over point to summer operation, the primary air is supplied at approximately 80 deg and furnishes heat if required when outdoor temperatures are in the 50 to 60 deg range. Cooling is provided as required by means of the same coil in the secondary air stream, which is supplied with chilled water during the summer cycle. The temperature of the primary air is gradually lowered from 80 deg (at 50 deg outdoor temperature) to 50 deg when the outdoor temperature reaches 80 deg or above.

The low pressure system is similar to the high pressure, except that rectangular ductwork and conventional air velocities are used. The 31 low pressure room units resemble the high pressure room units, but are different in that 50 deg primary air is supplied to them the year 'round — and, due to the lower jet velocity of the primary air, less secondary air is induced, the ratio being one-third primary air to two-thirds secondary air. The coil in the secondary air stream is supplied with 160 deg water the year 'round and acts as a reheater.

The low pressure units serve all interior spaces, where it is necessary to have a year 'round cooling medium available — which in this case is the primary air itself.

Approximately 1350 gpm of 56 deg well water is supplied by three wells for cooling purposes, process water and domestic use. About 950 gpm is used for cooling by circulating the water through removable header, cleanable tube type coils in the air conditioning apparatus, and then through condensers on the refrigeration machines. The water is then wasted, except for 200 gpm to supply the roof spray system.

The well water has a high iron content, and pressure type water filters remove the iron in order to prevent rust deposits in coils, piping and condensers. The water is also chlorinated to destroy bacteria and to prevent algae growth on the roof.

Additional cooling for the manufacturing building is provided by a 45 deg chilled water system circulating 835 gpm through chilled water coils, supplementing the well water coils. Refrigeration is supplied by a 525 ton centrifugal machine with capacity varied by means of speed control and automatic suction dampers.

Cooling for the office building is supplied by a 100 ton reciprocating machine equipped with automatic unloaders for capacity reduction, cooling 210 gpm of water to 42 deg.

The two chilled water systems are inter-connected to provide standby.

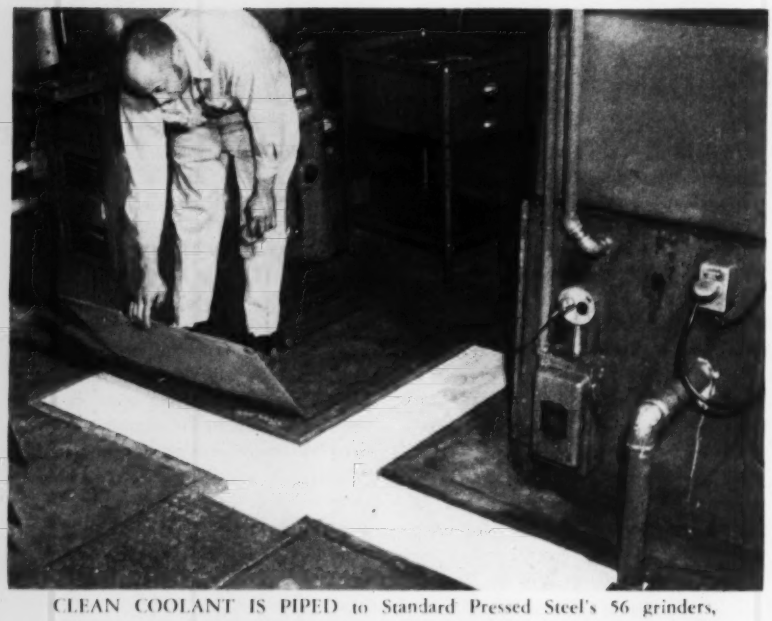
Spraying the roof with water offsets the sun load, which is equivalent to 33 tons of refrigeration.

Combining the cooling effect of the well water, mechanical refrigeration and roof sprays, there is a total equivalent load of 1090 tons of refrigeration.

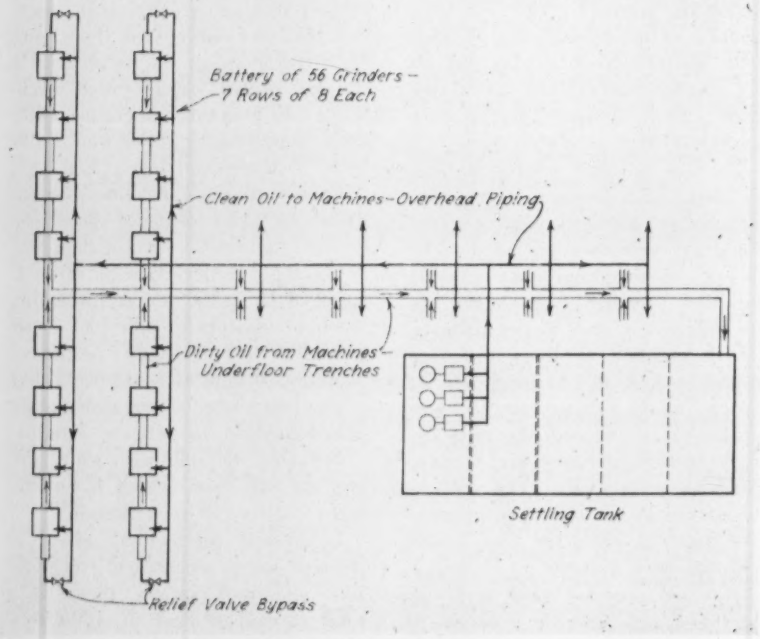
The project was engineered and built by The Austin Co.

Piping Coolant to Grinders

. . . . from central system has three main advantages, SPS finds: 1) Reduces machine downtime. 2) Saves manpower. 3) Extends wheel life



CLEAN COOLANT IS PIPED to Standard Pressed Steel's 56 grinders, and the dirty coolant oil is removed through channels or trenches under the floor (shown exposed here)



RELIEF VALVE at terminal end of each piping branch maintains a constant flow at each machine, also causes a continuous flushing action through the trenches to prevent accumulation of grinding sludge

To PROVIDE CLEAN coolant to a battery of 56 centerless grinders, the Standard Pressed Steel Co., Jenkintown, Pa., has installed a centralized automatic coolant system. Clean oil is conveyed to the machines through overhead piping, and is returned to the settling tank — where it is cleaned and aerated — in underfloor trenches.

Three Main Advantages of Central System

According to B. W. VanDyke, the plant engineer, there are three main advantages of the central system:

1) Reduced downtime on machines due to eliminating individual sump tank cleaning.

2) Saving in manpower, as all sludge is handled automatically.

3) Longer wheel life, better surface finish and longer diamond life.

Clean coolant comes to each machine through downpipes. Used oil leaving the machines returns to a dirty oil sump through a network of channels cut into the floor. Next, in a series of processing tanks, grinding sediment settles out from the oil and is removed by a pipe line drag conveyor.

Three 600 Gpm Coolant Circulating Pumps

The system has three 600 gpm coolant circulating pumps, with two in service and the third being a spare. The pumps are connected to a 6 in. discharge header and a 10 in. suction header. One pump is kept on the line at all times to provide continuous 24 hr aeration of the coolant and also to prevent grinding sludge from settling out in the piping and return trenches.

Piping is all steel, welded, with stop valves in the eight branches, each of which supplies a bank of seven machines. This enables any one line of seven machines to be taken out of service without interfering with the operation of the other machines. The pump discharge risers are 6 in. while the connecting branches are 3 and 4 in. pipe.

A constant flow at each machine is obtained by the use of a 10 lb relief valve installed at the terminal end of each branch. The discharge side of this valve is piped to the head end of the underfloor coolant return trenches. Not only does this feature prevent surges when one or more machines are shut down, but it also causes a continuous flushing action through the trenches to prevent accumulation of sludge.

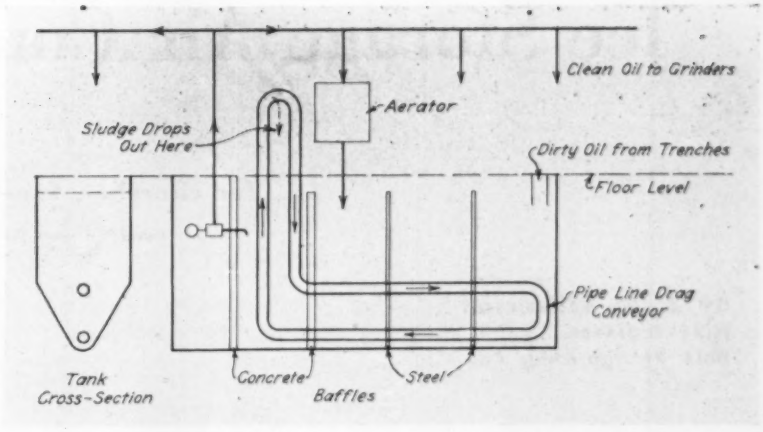
There is approximately 800 ft of welded steel pipe in this installation.

Bowers Bros. Co. was the piping contractor.

Part of $10 Million Expansion Program

This new coolant piping system is part of a $10 million machinery and plant expansion program scheduled for completion this year.

At that time, SPS will have 650,000 sq ft of integrated floor space under one roof for the manufacture of socket screws, self-locking nuts, steel shop equipment and aircraft specialty parts.



GRINDING SEDIMENT settles out of the used oil in this tank, is removed by a pipe line drag conveyor. The oil is also aerated for re-use

{The central coolant piping system for the new De Soto engine plant was described in detail by James C. Bishop in two articles published in the September and October issues of HPAC.}

GULF BUILDING INSTALLS 900 ROOM UNITS

A "MAJOR TREND" in the installation of room air conditioner units has been their adoption by multiple room structures such as office buildings, hotels and motels, according to Jack Cherry, manager of air conditioner sales of Philco Corp.

For example, the management of the Gulf building, in Pittsburgh, after a year and a half study, is installing 900 room air conditioners.

The decision to use a unit at the Gulf building which does not extend beyond the glass line was based on appearance considerations and partially on the fact that it is expected that within a few months legislation will be passed in Pennsylvania making this a legal requirement. In addition, window washing is difficult when air conditioners extend beyond the glass line.

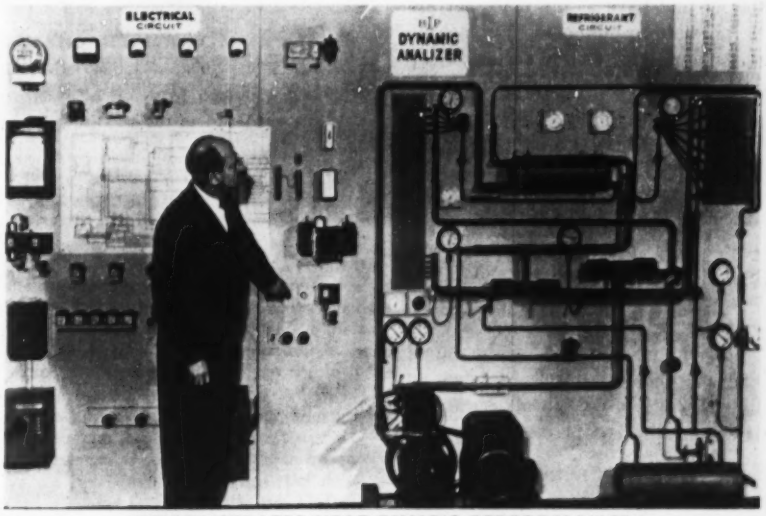
Other factors that led to the choice of room conditioners include ease of installation and service, both of which can be done by the building's maintenance department.

UNDERGROUND GAS STORAGE SOLVES PEAK LOAD PROBLEM

WITH THE NUMBER OF natural gas consumers doubled in the past 10 years, peak load demands have created a problem. Underground storage is the present solution, according to a paper presented by C. T. Konecny and B. J. Clarke of the Columbia Gas System Service Corp., Columbus, Ohio, at the spring meeting of the American Society of Mechanical Engineers.

In the Appalachian area during 35 percent of the year, due to winter temperatures, there is a 50 percent increase in the demand for gas, but cross-country pipe lines carrying gas from the Southwest cannot be economically operated at fluctuating loads, it was pointed out. The economical solution was the utilization of underground storage areas as close as possible to market areas.

Underground storage has another advantage. When unanticipated demands come (as when the temperature lowers suddenly) gas can be delivered with less delay. Since gas in pipe lines travels only 10 to 25 mph, a reduction in distance is important. Underground storage in the Appalachian area is as much as 1000 miles closer to the market than gas at the original Southwest sources.



DEMONSTRATES HEAT PUMP'S PERFORMANCE

THIS DYNAMIC ANALYZER is used at General Electric's Heat Pump Institute to demonstrate the performance characteristics of the heat pump. G. K. Marshall shows how the analyzer works

Ice Storage Air Conditioning

. . . . for churches, funeral homes and tourist courts — and to boost capacity of existing installations

By J. A. Wilkerson
Field Engineer
Dole Refrigerating Co.

ICE STORAGE SYSTEMS for air conditioning are applicable where there is a heavy cooling demand for a short duration, with sufficient time between cooling demands to recover the ice. The advantages resulting from the fact that large tonnage applications can be handled with a smaller horsepower compressor than is indicated by the tonnage of the load are a saving in the kw input to the compressor motor and a reduction in the electrical demand charges.

The latent heat storage idea has been used for air conditioning churches, funeral homes and tourist courts, and as a booster for supplying additional capacity to a direct expansion system.

Many in the refrigeration industry are familiar with dairy ice storage systems for cooling milk. The building of ice on plates or coils presents no difficulty. The problem is to melt the ice and have as much ice surface as possible exposed to the melting water flow. This can be accomplished with a motor-driven agitator, or by increasing the pump capacity beyond the gpm required by the air conditioning water coil.

In an air conditioning system, the maximum tons per hour, times the hours that the air conditioning will be required, establish the total ton-hours of available ice storage needed. In order to clearly approach any air conditioning application using latent heat storage, it is well to have an analysis or work sheet chart to determine the equipment necessary.

Some Fundamentals Reviewed

Before discussing a work sheet chart, it might be well to state some fundamental facts:

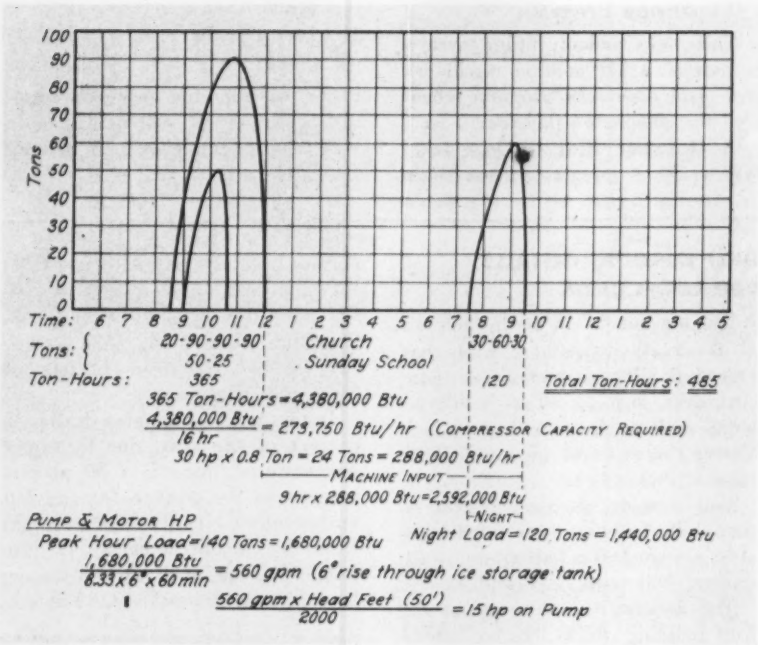

Tons
100
90
80
70
60
50
40
30
20
10
0
Time: 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5
Tons: 20-90-90-90
50-25
Church
Sunday School
30-60-30
Ton-Hours: 365
120
Total Ton-Hours: 485
365 Ton-Hours = 4,380,000 Btu
4,380,000 Btu / 16 hr = 273,750 Btu/hr (Compressor Capacity Required)
30 hp x 0.8 Ton = 24 Tons = 288,000 Btu/hr
Machine Input
9 hr x 288,000 Btu = 2,592,000 Btu
Night
Pump & Motor HP
Peak Hour Load = 140 Tons = 1,680,000 Btu
Night Load = 120 Tons = 1,440,000 Btu
1,680,000 Btu / 8.33 x 6° x 60 min = 560 gpm (6° rise through ice storage tank)
560 gpm x Head Feet (50') / 2000 = 15 hp on Pump

FIG. 1—WORK SHEET CHART for a church requiring 90 tons per hr for 3 hr, a 50 ton Sunday school load for 1½ hr during the same period, and a 60 ton load for 2 hr during the evening. The calculations shown are discussed in the text

1 cu ft of ice weighs approximately 56 lb. 1 sq ft of ice 1 in. thick weighs approximately 4.6 lb. 1 sq ft of ice 2½ in. thick weighs 11.5 lb.

A latent heat storage refrigeration plate 3 ft by 9 ft has 27 sq ft of surface on one side, or 54 sq ft for both sides. 54 sq ft of surface times 11.5 lb of ice equals 621 lb of ice per plate. 621 lb of ice equals 89,420 Btu per plate, as the latent heat of fusion of ice is 144 Btu per lb.

It can thus be determined that there is approximately 7½ tons of refrigeration of latent heat storage per plate.

The initial cost of a church air conditioning system is often paid by solicited donations, and in many cases does not present too difficult a problem. However, the operating cost after the system is installed must come out of current revenue. Obviously, it is much cheaper to pay electrical energy and demand charges for a smaller compressor than for a large machine.

Calculations for Church Cooling Load

To proceed with discussion of the work sheet chart, Fig. 1 is for a hypothetical church requiring 90 tons per hr for 3 hr. During the same period there is a Sunday school load of 50 tons per hr for 1½ hr. It is

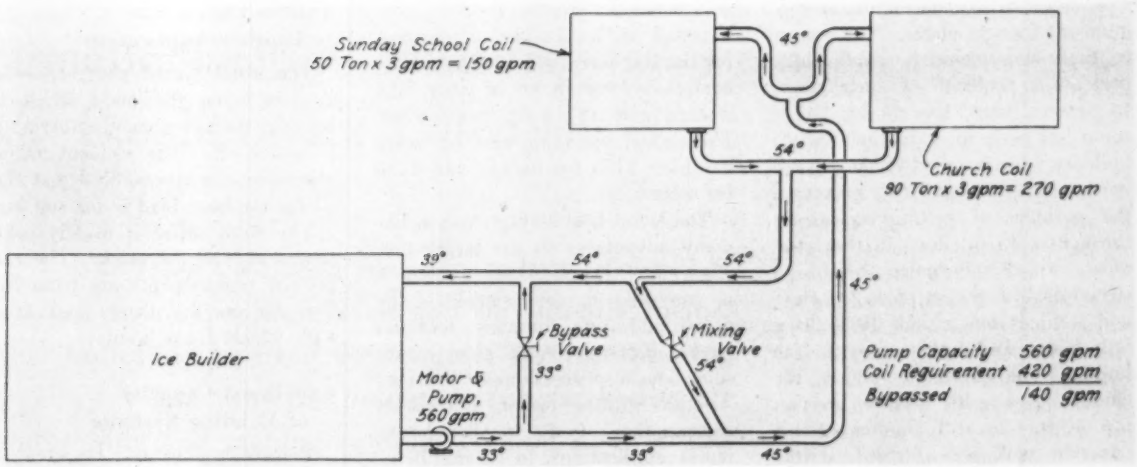


FIG. 2—SCHEMATIC PIPING DIAGRAM showing hypothetical water temperatures for the same installation referred to in Fig. 1. The excess water is bypassed to promote agitation in the ice tank

also necessary to provide a 60 ton per hr load for 2 hr for evening services.

Analyzing the church load, we find that in addition to the 90 ton per hr load for 3 hr, there is a 20 ton load. This load comes from the fact that the system is turned on ½ hr before services to take care of the latent heat of the air and the sensible heat of the pews and fixtures. Since this imposes an additional load, the total ton-hour figure for the church is 290. The Sunday School load during the same period is 75 ton-hours so that the total combined ton-hour load figure is 365.

Let us arbitrarily decide that we would like to recover the ice in 16 hr. The 365 ton-hours is equal to 4,380,000 Btu. This 4,380,000 Btu, divided by 16 hr, establishes the fact that a compressor with a Btu capacity of 273,750 Btu per hr is required.

At 20 deg suction, we can obtain 0.8 ton per hp. Selecting a 30 hp compressor, we find that 30 hp × 0.8 ton equals 24 tons of refrigeration, or 288,000 Btu per hr. This is sufficient to recover the ice in 16 hr.

A rule-of-thumb method to approximate the compressor for a given application is to take 25 to 33 percent of the peak hour load to determine the necessary compressor horsepower.

For the evening service, we have 60 tons per hr for 2 hr, or 120 ton-hours, which is equal to 1,440,000 Btu. If the ice were completely melted during the morning services, there would be 9 hr for recovery or compressor input. (Seven hours before and 2 hr during the evening service.) This would amount to 9 hr × 288,000 Btu = 2,592,000 Btu, or over a million Btu's in excess of requirements.

The ice would be recovered in 16 hr, so that meetings could be held every night of the week. There are also some safety factors that have not been calculated.

1) Since good engineering decrees that load estimates be calculated at the 4 p.m. sun effect, it follows that the ambient temperature at night during the service would be lower.

2) The rise in the heat content of the water from 33 deg to 45 deg has not been taken into account.

The number of latent heat storage refrigeration plates required would depend on the elected operating conditions:

Full capacity latent heat storage: 4,380,000 Btu for 365 ton-hours divided by 89,420 Btu per plate = 48 plates.

Or: 4,380,000 Btu for 365 ton-hours minus 864,000 Btu compressor input during services = 3,516,000 Btu storage required. 3,516,000 Btu storage required divided by 89,420 Btu per plate = 39 plates.

Determining Pump and Motor Requirements

Continuing with Fig. 1 for the pump and motor requirements, it is advisable to consult the pump manufacturer to determine the best type of pump to use. However, to arrive at the gpm required, we divide the peak load per hr by the weight of water × 6 deg temperature rise × 60 minutes. This indicates that 560 gpm is required. The 6 deg rise is between the discharged and returned water through the ice bank and is not to be confused with the water temperature rise and gpm through the water coil, which is generally calculated as 3 gpm per ton, with an 8 deg rise in temperature.

Water that is in excess of the gpm required by the air conditioning coil is bypassed to set up agitation for the melting of the ice, as indicated in Fig. 2.

The pump horsepower may be determined by multiplying the gpm by the head in feet and dividing by a 2000 factor (see Fig. 1.) Since a 100 percent efficient pump and motor would pump 3960 gpm per hp per foot of head, we discount the pump capacity 30 percent and the motor efficiency 30 percent and arrive at a factor of approximately 2000 gpm — which in this case would indicate a 15 hp motor on the pump is necessary.

Fig. 2 shows, for this installation, a hypothetical water temperature condition, the manner of bypassing the excess gpm to promote agitation, the water tempering or mixing valve, and hypothetical water temperatures in the discharge and return water lines.

Storage Plates Installed In Many Ways

Latent heat storage plates for building up the ice are available in

assemblies of six plates or in any number of single plates. The reason is that many church applications present a problem of installation. In several cases, the church boiler room has been so small that the ice builders were installed in the church yard. Another installation presented the problem of getting equipment through a 30 in. door in the basement. In this instance, the 10 ga steel was brought in piece by piece and welded into a tank 10 x 20 x 5 ft high. In another case, the ice builder was installed under the church lawn, with a rose bed on top of it. In still another case a concrete tank was formed at the outside rear of the church. For a proposed application, the ice builder will be installed on the roof, much like a cooling tower.

Stratified Cooling Reduces the Load

It is not necessary to condition the upper portion of the church structure. A stratified air blanket 12 to 14 ft above floor level is all that is required. This is accomplished by discharging the air at floor level at a 45 deg angle, or from outlets placed 10 to 12 ft above the floor level on the walls.

Since the architectural design of some churches will not permit this method, the air discharge may be from the ceiling, although discharging from the ceiling increases the tonnage load.

The chilled water can be zoned and pumped to other meeting rooms for weekly meetings, without air conditioning the entire church when not necessary. The pastor's study — a load of 2 to 3 tons per day — can be handled without seriously unbalancing the system.

Roman Catholic churches do not present any particular problem, even though masses continue until noon. Early morning masses do not approach the design load conditions. The heavy load is from 10 a.m. until noon. For the weekday load, masses are generally from 6 a.m. until 8:30 a.m. The church can be zoned and the first 12 or 15 pews can be in this zone.

Confessionals are generally in the rear of the church. This area can be zoned for Saturday afternoon and evening, and a small air unit can be installed in the confessionals.

A Catholic church in St. Louis has had an ice builder application for the last seven years. The system comprises 75 ton-hours of latent heat storage and a 7½ hp compressor. The annual operating cost for years has been $185 for energy and $120 for water.

The latent heat storage system has many advantages in the larger tonnage church applications. While it is true that in some localities the power and light company does not have a demand charge — or makes some special concessions to churches — the utilities prefer a constant consumption of the smaller horsepower applications, to having 10 or 12 churches switch on a 90 to 100 hp load for 2 hr on Sunday. Another advantage is that when there is a church supper or gathering, with an occupancy load of 250 to 300 people, it is not necessary to turn on 50 to 75 hp to accommodate a 15 ton load.

Applying Ice Storage To Funeral Homes

In funeral homes, the cooling load is intermittent. The chilled water may be zoned to several rooms.

The casket sales room is air conditioned and the unit may be turned on about ½ hr before its use. This is a small load for about 1 hr.

The slumber room and reception room are generally conditioned from noon on, but the peak occupancy load does not come on until the evening and is generally over by 10 p.m. This room should be calculated for peak occupancy conditions.

The chapel is conditioned on the day of the funeral about ½ hr before the service — which rarely lasts more than ½ hr. The chapel should be designed for a peak occupancy load for about 1 hr.

The office, which generally represents a small tonnage load, can be on for the 12 or 14 hr day and is often not more than a ¾ ton load. This can be taken from compressor input without unbalancing the operation. Generally speaking, a 2 or 3 hp compressor will suffice where there is ample recovery time between funerals. Where there is a possibility of two or more funerals on the same day, more ice storage may be needed. If an extreme condition developed, which would not happen too often, then the unit can be fortified with purchased ice.

Tourist Courts Are Another Application

The usual tourist court operation is that when the maid strips the linen in the morning, the thermostat is turned off. The ambient temperature drops to around 85 deg at night so the ton-hour load is not too high.

The court office is usually conditioned around the clock. The compressor requirements are from 5 to 7½ hp on the three applications with which I am familar.

Can Boost Capacity of Existing Systems

Booster applications represent another potential use of the ice storage idea. Many air conditioning installations do not have sufficient tonnage. This may occur from the fact that the job was "sold at a price," or that the occupancy load condition may have changed.

After the day load of the direct expansion system has been handled, the compressor may be used to build ice overnight. This application has a lot of merit, especially in restaurants, where the peak loads are from 11 a.m. to 2 p.m. and from 5 p.m. until 8 p.m.

An installation is now being contemplated for a bowling alley where the 50 ton direct expansion system does an excellent job from about 10 a.m. until 6:30 p.m., when the alleys start filling up for the evening. From 6:30 until 11 p.m. an additional 25 tons capacity is indicated. The latent heat storage unit proposed would use the 50 hp compressor to build ice overnight to supply the additional 100 ton-hour load (25 tons for 4 hr). The equipment required would be a latent heat or ice storage unit, pump, piping and an air handling unit for the additional load.

In summarizing the applications of ice storage, where a large tonnage is required up to 6 hr — as in churches — latent heat storage systems have a definite advantage. Smaller tonnage applications, where zoning is indicated and the load is not constant — such as some types of tourist courts and funeral homes — represent another good use for latent heat storage. As a booster for additional tonnage in a previously installed direct expansion system, latent heat is often the right answer.

Climatic Factors Measure Air Conditioning Potentials

Here's a listing for each county in the U.S. of its degree-hour zone and its climatic factor, indicating its need for summer air conditioning and thus the potentials for marketing air conditioning and making summer cooling installations

By John R. Hertzler and V. T. Kartorie

Vice President and General Sales Manager, and Manager, Market Research, respectively
York Corp.

NATIONAL DISTRIBUTION of summer air conditioning products needs a set of base criteria which can be used to measure the effectiveness of distribution and plan marketing activities, it was pointed out in our article in the May HPAC.

Since people are prompted to purchase air conditioning systems for comfort by their own discomfort — both its *intensity* and *duration* — it is desirable to develop formulas for measuring those climatic factors which create discomfort.

As was described in May, weather data have been analyzed and summarized and climatic factors calculated based on weighting the duration of wet bulb temperatures of 66 F or higher as the greatest single factor in the measurement of discomfort. For instance, in Boston, the duration of wet bulb temperatures of 66 F and higher, in the four summer months, June through September, 24 hr per day, embraces 29.7 percent of the time. This duration weighted at 78.2 percent, design dry bulb temperature weighted at 8.3 percent, and design wet bulb temperature weighted at 13.5 percent develop an overall climatic factor which would indicate summer discomfort imposed by climate in Boston as about 35.6 percent as severe as the climatic discomfort of the state of Florida — the area of greatest summer discomfort in accordance with the studies.

The distribution of retail sales by states has been used in Fig. 3 of the May article to indicate graphically the relative importance of the states as to their need for and capacity to purchase capital goods which, in turn, could be used to develop business.

Application of the climatic factors, as calculated, to the retail sales distribution by states makes it possible in Fig. 4 of the May article to develop a graphic portrayal of the market for commercial air conditioning for summer comfort in the United States.

Similarly, climatic factors developed by the use of degree day information for the various states makes it possible in Fig. 5 of the May article to show graphically the market for heating equipment in a relative way, using retail sales as the base.

In the May article, the degree-hour zones were shown on an outline map in Fig. 2 and the zones, with their climatic factors, were listed by states in Table 2. Table 3, published this month, gives these figures by individual counties.

TABLE 3—SUMMER CLIMATIC FACTORS and degree-hour zones for all counties of the United States. (The standard code numbers shown for the states and counties are from the County and City Data Book, 1949, Bureau of the Census, pp. 74-337. The degree-hour zone numbers correspond to Table 2 and Fig. 2 on pp. 80-82 of the May 1953 HPAC. The climatic factors correspond to those in Table 2 on pp. 80-81 of the May 1953 HPAC.)

Code	County	Degree-Hour Zone	Climatic Factor	Code	County	Degree-Hour Zone	Climatic Factor	Code	County	Degree-Hour Zone	Climatic Factor
	ALABAMA — 01			20	Covington	2	.912	41	Lee	2	.912
				21	Crenshaw	2	.912	42	Limestone	1	.848
1	Autauga	2	.912	22	Cullman	1	.848	43	Lowndes	2	.912
2	Baldwin	2	.912	23	Dale	2	.912	44	Macon	2	.912
3	Barbour	2	.912	24	Dallas	2	.912	45	Madison	1	.848
4	Bibb	1	.848	25	DeKalb	1	.848	46	Marengo	2	.912
5	Blount	1	.848	26	Elmore	2	.912	47	Marion	1	.848
6	Bullock	2	.912	27	Escambia	2	.912	48	Marshall	1	.848
7	Butler	2	.912	28	Etowah	1	.848	49	Mobile	3	.955
8	Calhoun	1	.848	29	Fayette	1	.848	50	Monroe	2	.912
9	Chambers	1	.848	30	Franklin	1	.848	51	Montgomery	2	.912
10	Cherokee	1	.848	31	Geneva	2	.912	52	Morgan	1	.848
11	Chilton	1	.848	32	Greene	2	.912	53	Perry	2	.912
12	Choctaw	2	.912	33	Hale	2	.912	54	Pickens	1	.848
13	Clarke	2	.912	34	Henry	2	.912	55	Pike	2	.912
14	Clay	1	.848	35	Houston	2	.912	56	Randolph	1	.848
15	Cleburne	1	.848	36	Jackson	1	.848	57	Russell	2	.912
16	Coffee	2	.912	37	Jefferson	1	.848	58	St. Clair	1	.848
17	Colbert	1	.848	38	Lamar	1	.848	59	Shelby	1	.848
18	Conecuh	2	.912	39	Lauderdale	1	.848	60	Sumter	2	.912
19	Coosa	1	.848	40	Lawrence	1	.848	61	Talladega	1	.848
								62	Tallapoosa	1	.848

Code	County	Degree-Hour Zone	Climatic Factor
	Alabama (continued)		
63	Tuscaloosa	1	.848
64	Walker	1	.848
65	Washington	3	.955
66	Wilcox	2	.912
67	Winston	1	.848
	ARIZONA — 02		
1	Apache	1	.115
2	Cochise	2	.155
3	Coconino	1	.115
4	Gila	2	.155
5	Graham	2	.155
6	Greenlee	1	.115
7	Maricopa	3	.673
8	Mohave	2	.155
9	Navajo	1	.115
10	Pima	4	.363
11	Pinal	4	.363
12	Santa Cruz	4	.363
13	Yavapai	2	.155
14	Yuma	5	.726
	ARKANSAS — 03		
1	Arkansas	1	.887
2	Ashley	1	.887
3	Baxter	1	.887
4	Benton	1	.887
5	Boone	1	.887
6	Bradley	1	.887
7	Calhoun	1	.887
8	Carroll	1	.887
9	Chicot	1	.887
10	Clark	1	.887
11	Clay	1	.887
12	Cleburne	1	.887
13	Cleveland	1	.887
14	Columbia	2	.919
15	Conway	1	.887
16	Craighead	1	.887
17	Crawford	1	.887
18	Crittenden	1	.887
19	Cross	1	.887
20	Dallas	1	.887
21	Desha	1	.887
22	Drew	1	.887
23	Faulkner	1	.887
24	Franklin	1	.887
25	Fulton	1	.887
26	Garland	1	.887
27	Grant	1	.887
28	Greene	1	.887
29	Hempstead	2	.919
30	Hot Spring	1	.887
31	Howard	1	.887
32	Independence	1	.887
33	Izard	1	.887
34	Jackson	1	.887
35	Jefferson	1	.887
36	Johnson	1	.887
37	Lafayette	2	.919
38	Lawrence	1	.887
39	Lee	1	.887
40	Lincoln	1	.887
41	Little River	2	.919
42	Logan	1	.887
43	Lonoke	1	.887
44	Madison	1	.887
45	Marion	1	.887
46	Miller	2	.919
47	Mississippi	1	.887
48	Monroe	1	.887
49	Montgomery	1	.887
50	Nevada	2	.919
51	Newton	1	.887
52	Ouachita	1	.887
53	Perry	1	.887
54	Phillips	1	.887
55	Pike	1	.887
56	Poinsett	1	.887
57	Polk	1	.887
58	Pope	1	.887
59	Prairie	1	.887
60	Pulaski	1	.887
61	Randolph	1	.887
62	St. Francis	1	.887
63	Saline	1	.887
64	Scott	1	.887
65	Searcy	1	.887
66	Sebastian	2	.919
67	Sevier	2	.919
68	Sharp	1	.887
69	Stone	1	.887
70	Union	1	.887
71	Van Buren	1	.887
72	Washington	1	.887
73	White	1	.887
74	Woodruff	1	.887
75	Yell	1	.887
	CALIFORNIA — 04		
1	Alameda	1	.077
2	Alpine	1	.077
3	Amador	2	.289
4	Butte	2	.289
5	Calaveras	2	.289
6	Colusa	2	.289
7	Contra Costa	1	.077
8	Del Norte	1	.077
9	Eldorado	2	.289
10	Fresno	2	.289
11	Glenn	2	.289
12	Humboldt	1	.077
13	Imperial	5	.726
14	Inyo	1	.077
15	Kern	1	.077
16	Kings	2	.289
17	Lake	1	.077
18	Lassen	1	.077
19	Los Angeles	3	.150
20	Madera	2	.289
21	Marin	1	.077
22	Mariposa	2	.289
23	Mendocino	1	.077
24	Merced	2	.289
25	Modoc	1	.077
26	Mono	1	.077
27	Monterey	1	.077
28	Napa	1	.077
29	Nevada	2	.289
30	Orange	3	.150
31	Placer	2	.289
32	Plumas	1	.077
33	Riverside	4	.353
34	Sacramento	2	.289
35	San Benito	1	.077
36	San Bernardino	3	.150
37	San Diego	4	.353
38	San Francisco	1	.077
39	San Joaquin	2	.289
40	San Luis Obispo	1	.077
41	San Mateo	1	.077
42	Santa Barbara	1	.077
43	Santa Clara	1	.077
44	Santa Cruz	1	.077
45	Shasta	1	.077
46	Sierra	1	.077
47	Siskiyou	1	.077
48	Solano	2	.289
49	Sonoma	1	.077
50	Stanislaus	2	.289
51	Sutter	2	.289
52	Tehama	2	.289
53	Trinity	1	.077
54	Tulare	2	.289
55	Tuolumne	2	.289
56	Ventura	1	.077
57	Yolo	2	.289
58	Yuba	2	.289
	COLORADO — 05		
—	All counties	1	.084
	CONNECTICUT — 06		
—	All counties	1	.446
	DELAWARE — 07		
—	All counties	1	.733
	DISTRICT OF COLUMBIA — 08		
1	Washington	1	.733
	FLORIDA — 09		
—	All counties	1	1.000
	GEORGIA — 10		
1	Appling	3	.912
2	Atkinson	3	.912
3	Bacon	3	.912
4	Baker	3	.912
5	Baldwin	1	.845
6	Banks	1	.845
7	Barrow	1	.845
8	Bartow	1	.845
9	Ben Hill	3	.912
10	Berrien	3	.912
11	Bibb	1	.845
12	Bleckley	3	.912
13	Brantley	2	.946
14	Brooks	3	.912
15	Bryan	2	.946
16	Bulloch	2	.946
17	Burke	1	.845
18	Butts	1	.845
19	Calhoun	3	.912
20	Camden	2	.946
21	Candler	3	.912
22	Carroll	1	.845
23	Catoosa	1	.845
24	Charlton	2	.946
25	Chatham	2	.946
26	Chattahoochee	3	.912
27	Chattooga	1	.845
28	Cherokee	1	.845
29	Clarke	1	.845
30	Clay	3	.912
31	Clayton	1	.845
32	Clinch	3	.912
33	Cobb	1	.845
34	Coffee	3	.912
35	Colquitt	3	.912
36	Columbia	1	.845
37	Cook	3	.912
38	Coweta	1	.845
39	Crawford	1	.845
40	Crisp	3	.912
41	Dade	1	.845
42	Dawson	1	.845
43	Decatur	3	.912
44	DeKalb	1	.845
45	Dodge	3	.912
46	Dooly	3	.912
47	Dougherty	3	.912
48	Douglas	1	.845
49	Early	3	.912
50	Echols	3	.912
51	Effingham	2	.946
52	Elbert	1	.845
53	Emanuel	3	.912
54	Evans	2	.946
55	Fannin	1	.845
56	Fayette	1	.845
57	Floyd	1	.845
58	Forsyth	1	.845
59	Franklin	1	.845
60	Fulton	1	.845
61	Gilmer	1	.845
62	Glascock	1	.845
63	Glynn	2	.946
64	Gordon	1	.845
65	Grady	3	.912
66	Greene	1	.845
67	Gwinnett	1	.845
68	Habersham	1	.845
69	Hall	1	.845
70	Hancock	1	.845
71	Haralson	1	.845
72	Harris	1	.845
73	Hart	1	.845
74	Heard	1	.845
75	Henry	1	.845
76	Houston	3	.912
77	Irwin	3	.912
78	Jackson	1	.845
79	Jasper	1	.845
80	Jeff Davis	3	.912
81	Jefferson	1	.845
82	Jenkins	1	.845
83	Johnson	1	.845
84	Jones	1	.845
85	Lamar	1	.845
86	Lanier	3	.912
87	Laurens	3	.912
88	Lee	3	.912
89	Liberty	2	.946
90	Lincoln	1	.845
91	Long	2	.946
92	Lowndes	3	.912
93	Lumpkin	1	.845
94	McDuffie	1	.845
95	McIntosh	2	.946
96	Macon	3	.912
97	Madison	1	.845
98	Marion	3	.912
99	Meriwether	1	.845
100	Miller	3	.912
101	Mitchell	3	.912
102	Monroe	1	.845
103	Montgomery	3	.912
104	Morgan	1	.845
105	Murray	1	.845
106	Muscogee	3	.912
107	Newton	1	.845
108	Oconee	1	.845
109	Oglethorpe	1	.845
110	Paulding	1	.845
111	Peach	1	.845
112	Pickens	1	.845
113	Pierce	3	.912
114	Pike	1	.845
115	Polk	1	.845
116	Pulaski	3	.912
117	Putnam	1	.845
118	Quitman	3	.912
119	Rabun	1	.845
120	Randolph	3	.912
121	Richmond	1	.845
122	Rockdale	1	.845
123	Schley	3	.912
124	Screven	2	.946
125	Seminole	3	.912
126	Spalding	1	.845
127	Stephens	1	.845
128	Stewart	3	.912
129	Sumter	3	.912
130	Talbot	1	.845
131	Taliaferro	1	.845
132	Tattnall	2	.946
133	Taylor	3	.912
134	Telfair	3	.912
135	Terrell	3	.912
136	Thomas	3	.912
137	Tift	3	.912
138	Toombs	3	.912
139	Towns	1	.845
140	Treutlen	3	.912
141	Troup	1	.845
142	Turner	3	.912

Code	County	Degree-Hour Zone	Climatic Factor
	Georgia (continued)		
143	Twiggs	1	.845
144	Union	1	.845
145	Upson	1	.845
146	Walker	1	.845
147	Walton	1	.845
148	Ware	3	.912
149	Warren	1	.845
150	Washington	1	.845
151	Wayne	2	.946
152	Webster	3	.912
153	Wheeler	3	.912
154	White	1	.845
155	Whitfield	1	.845
156	Wilcox	3	.912
157	Wilkes	1	.845
158	Wilkinson	1	.845
159	Worth	3	.912
	IDAHO — 11		
1	Ada	1	.081
2	Adams	1	.081
3	Bannock	1	.081
4	Bear Lake	1	.081
5	Benewah	1	.081
6	Bingham	1	.081
7	Blaine	1	.081
8	Boise	2	.103
9	Bonner	1	.081
10	Bonneville	1	.081
11	Boundary	1	.081
12	Butte	1	.081
13	Camas	1	.081
14	Canyon	1	.081
15	Caribou	1	.081
16	Cassia	1	.081
17	Clark	1	.081
18	Clearwater	1	.081
19	Custer	1	.081
20	Elmore	1	.081
21	Franklin	1	.081
22	Fremont	1	.081
23	Gem	1	.081
24	Goodling	1	.081
25	Idaho	1	.081
26	Jefferson	1	.081
27	Jerome	1	.081
28	Kootenai	1	.081
29	Latah	1	.081
30	Lemhi	1	.081
31	Lewis	1	.081
32	Lincoln	1	.081
33	Madison	1	.081
34	Minidoka	1	.081
35	Nez Perce	1	.081
36	Oneida	1	.081
37	Owyhee	1	.081
38	Payette	1	.081
39	Power	1	.081
40	Shoshone	1	.081
41	Teton	1	.081
42	Twin Falls	1	.081
43	Valley	1	.081
44	Washington	1	.081
45	Yellowstone Nat'l Park (Part)	1	.081
	ILLINOIS — 12		
1	Adams	3	.680
2	Alexander	3	.680
3	Bond	3	.680
4	Boone	1	.449
5	Brown	3	.680
6	Bureau	2	.543
7	Calhoun	3	.680
8	Carroll	2	.543
9	Cass	2	.543
10	Champaign	1	.449
11	Christian	3	.680
12	Clark	1	.449
13	Clay	3	.680
14	Clinton	3	.680
15	Coles	1	.449
16	Cook	1	.449
17	Crawford	3	.680
18	Cumberland	1	.449
19	DeKalb	1	.449
20	DeWitt	1	.449
21	Douglas	1	.449
22	Du Page	1	.449
23	Edgar	1	.449
24	Edwards	3	.680
25	Effingham	3	.680
26	Fayette	3	.680
27	Ford	1	.449
28	Franklin	3	.680
29	Fulton	2	.543
30	Gallatin	3	.680
31	Greene	3	.680
32	Grundy	1	.449
33	Hamilton	3	.680
34	Hancock	2	.543
35	Hardin	3	.680
36	Henderson	2	.543
37	Henry	2	.543
38	Iroquois	1	.449
39	Jackson	3	.680
40	Jasper	3	.680
41	Jefferson	3	.680
42	Jersey	3	.680
43	Jo Daviess	2	.543
44	Johnson	3	.680
45	Kane	1	.449
46	Kankakee	1	.449
47	Kendall	1	.449
48	Knox	2	.543
49	Lake	1	.449
50	La Salle	1	.449
51	Lawrence	3	.680
52	Lee	2	.543
53	Livingston	1	.449
54	Logan	2	.543
55	McDonough	2	.543
56	McHenry	1	.449
57	McLean	1	.449
58	Macon	1	.449
59	Macoupin	3	.680
60	Madison	3	.680
61	Marion	3	.680
62	Marshall	2	.543
63	Mason	2	.543
64	Massac	3	.680
65	Menard	2	.543
66	Mercer	2	.543
67	Monroe	3	.680
68	Montgomery	3	.680
69	Morgan	3	.680
70	Moultrie	1	.449
71	Ogle	2	.543
72	Peoria	2	.543
73	Perry	3	.680
74	Piatt	1	.449
75	Pike	3	.680
76	Pope	3	.680
77	Pulaski	3	.680
78	Putnam	2	.543
79	Randolph	3	.680
80	Richland	3	.680
81	Rock Island	2	.543
82	St. Clair	3	.680
83	Saline	3	.680
84	Sangamon	3	.680
85	Schuyler	2	.543
86	Scott	3	.680
87	Shelby	1	.449
88	Stark	2	.543
89	Stephenson	2	.543
90	Tazewell	2	.543
91	Union	3	.680
92	Vermilion	1	.449
93	Wabash	3	.680
94	Warren	2	.543
95	Washington	3	.680
96	Wayne	3	.680
97	White	3	.680
98	Whiteside	2	.543
99	Will	1	.449
100	Williamson	3	.680
101	Winnebago	1	.449
102	Woodford	2	.543
	INDIANA — 13		
1	Adams	1	.449
2	Allen	1	.449
3	Bartholomew	2	.759
4	Benton	1	.449
5	Blackford	1	.449
6	Boone	1	.449
7	Brown	2	.759
8	Carroll	1	.449
9	Cass	1	.449
10	Clark	2	.759
11	Clay	2	.759
12	Clinton	1	.449
13	Crawford	2	.759
14	Daviess	2	.759
15	Dearborn	2	.759
16	Decatur	2	.759
17	De Kalb	1	.449
18	Delaware	1	.449
19	Dubois	2	.759
20	Elkhart	1	.449
21	Fayette	2	.759
22	Floyd	2	.759
23	Fountain	1	.449
24	Franklin	2	.759
25	Fulton	1	.449
26	Gibson	2	.759
27	Grant	1	.449
28	Greene	2	.759
29	Hamilton	1	.449
30	Hancock	1	.449
31	Harrison	2	.759
32	Hendricks	1	.449
33	Henry	1	.449
34	Howard	1	.449
35	Huntington	1	.449
36	Jackson	2	.759
37	Jasper	1	.449
38	Jay	1	.449
39	Jefferson	2	.759
40	Jennings	2	.759
41	Johnson	2	.759
42	Knox	2	.759
43	Kosciusko	1	.449
44	Lagrange	1	.449
45	Lake	1	.449
46	La Porte	1	.449
47	Lawrence	2	.759
48	Madison	1	.449
49	Marion	1	.449
50	Marshall	1	.449
51	Martin	2	.759
52	Miami	1	.449
53	Monroe	2	.759
54	Montgomery	1	.449
55	Morgan	2	.759
56	Newton	1	.449
57	Noble	1	.449
58	Ohio	2	.759
59	Orange	2	.759
60	Owen	2	.759
61	Parke	1	.449
62	Perry	2	.759
63	Pike	2	.759
64	Porter	1	.449
65	Posey	2	.759
66	Pulaski	1	.449
67	Putnam	1	.449
68	Randolph	1	.449
69	Ripley	2	.759
70	Rush	2	.759
71	St. Joseph	1	.449
72	Scott	2	.759
73	Shelby	2	.759
74	Spencer	2	.759
75	Starke	1	.449
76	Steuben	1	.449
77	Sullivan	2	.759
78	Switzerland	2	.759
79	Tippecanoe	1	.449
80	Tipton	1	.449
81	Union	2	.759
82	Vanderburgh	2	.759
83	Vermillion	1	.449
84	Vigo	1	.449
85	Wabash	1	.449
86	Warren	1	.449
87	Warrick	2	.759
88	Washington	2	.759
89	Wayne	2	.759
90	Wells	1	.449
91	White	1	.449
92	Whitley	1	.449
	IOWA — 14		
—	All counties	1	.591
	KANSAS — 15		
1	Allen	1	.676
2	Anderson	1	.676
3	Atchison	2	.604
4	Barber	3	.365
5	Barton	3	.365
6	Bourbon	1	.676
7	Brown	2	.604
8	Butler	1	.676
9	Chase	2	.604
10	Chautauqua	1	.676
11	Cherokee	1	.676
12	Cheyenne	3	.365
13	Clark	3	.365
14	Clay	2	.604
15	Cloud	2	.604
16	Coffey	1	.676
17	Comanche	3	.365
18	Cowley	1	.676
19	Crawford	1	.676
20	Decatur	3	.365
21	Dickinson	2	.604
22	Doniphan	2	.604
23	Douglas	2	.604
24	Edwards	3	.365
25	Elk	1	.676
26	Ellis	3	.365
27	Ellsworth	2	.604
28	Finney	3	.365
29	Ford	3	.365
30	Franklin	1	.676
31	Geary	2	.604
32	Gove	3	.365
33	Graham	3	.365
34	Grant	3	.365
35	Gray	3	.365
36	Greeley	3	.365
37	Greenwood	1	.676
38	Hamilton	3	.365
39	Harper	2	.604
40	Harvey	2	.604
41	Haskell	3	.365
42	Hodgeman	3	.365
43	Jackson	2	.604
44	Jefferson	2	.604
45	Jewell	2	.604
46	Johnson	2	.604
47	Kearney	3	.365
48	Kingman	2	.604
49	Kiowa	3	.365
50	Labette	1	.676
51	Lane	3	.365
52	Leavenworth	2	.604
53	Lincoln	2	.604

Code	County	Degree-Hour Zone	Climatic Factor
	Kansas (continued)		
54	Linn	1	.676
55	Logan	3	.365
56	Lyon	2	.604
57	McPherson	2	.604
58	Marion	2	.604
59	Marshall	2	.604
60	Meade	3	.365
61	Miami	1	.676
62	Mitchell	2	.604
63	Montgomery	1	.676
64	Morris	2	.604
65	Morton	3	.365
66	Nemaha	2	.604
67	Neosho	1	.676
68	Ness	3	.365
69	Norton	3	.365
70	Osage	2	.604
71	Osborne	3	.365
72	Ottawa	2	.604
73	Pawnee	3	.365
74	Phillips	3	.365
75	Pottawatomie	2	.604
76	Pratt	3	.365
77	Rawlins	3	.365
78	Reno	2	.604
79	Republic	2	.604
80	Rice	2	.604
81	Riley	2	.604
82	Rooks	3	.365
83	Rush	3	.365
84	Russell	3	.365
85	Saline	2	.604
86	Scott	3	.365
87	Sedgwick	2	.604
88	Sewa.[4]	3	.365
89	Shawnee	2	.604
90	Sheridan	3	.365
91	Sherman	3	.365
92	Smith	3	.365
93	Stafford	3	.365
94	Stanton	3	.365
95	Stevens	3	.365
96	Sumner	1	.676
97	Thomas	3	.365
98	Trego	3	.365
99	Wabaunsee	2	.604
100	Wallace	3	.365
101	Washington	2	.604
102	Wichita	3	.365
103	Wilson	1	.676
104	Woodson	1	.676
105	Wyandotte	2	.604
	KENTUCKY — 16		
—	All counties	1	.720
	LOUISIANA — 17		
1	Acadia	2	.982
2	Allen	2	.982
3	Ascension	2	.982
4	Assumption	2	.982
5	Avoyelles	1	.919
6	Beauregard	2	.982
7	Bienville	1	.919
8	Bossier	1	.919
9	Caddo	1	.919
10	Calcasieu	2	.982
11	Caldwell	1	.919
12	Cameron	2	.982
13	Catahoula	1	.919
14	Claiborne	1	.919
15	Concordia	1	.919
16	De Soto	1	.919
17	East Baton Rouge	2	.982
18	East Carroll	1	.919
19	East Feliciana	2	.982
20	Evangeline	2	.982
21	Franklin	1	.919
22	Grant	1	.919
23	Iberia	2	.982
24	Iberville	2	.982
25	Jackson	1	.919
26	Jefferson	2	.982
27	Jefferson Davis	2	.982
28	Lafayette	2	.982
29	Lafourche	2	.982
30	La Salle	1	.919
31	Lincoln	1	.919
32	Livingston	2	.982
33	Madison	1	.919
34	Morehouse	1	.919
35	Natchitoches	1	.919
36	Orleans	2	.982
37	Ouachita	1	.919
38	Plaquemines	2	.982
39	Pointe Coupee	2	.982
40	Rapides	1	.919
41	Red River	1	.919
42	Richland	1	.919
43	Sabine	1	.919
44	St. Bernard	2	.982
45	St. Charles	2	.982
46	St. Helena	2	.982
47	St. James	2	.982
48	St. John the Bap'ist	2	.982
49	St. Landry	2	.982
50	St. Martin	2	.982
51	St. Mary	2	.982
52	St. Tammany	2	.982
53	Tangipahoa	2	.982
54	Tensas	1	.919
55	Terrebonne	2	.982
56	Union	1	.919
57	Vermilion	2	.982
58	Vernon	1	.919
59	Washington	2	.982
60	Webster	1	.919
61	West Baton Rouge	2	.982
62	West Carroll	1	.919
63	West Feliciana	2	.982
64	Winn	1	.919
	MAINE — 18		
1	Androscoggin	2	.159
2	Aroostook	1	.121
3	Cumberland	2	.159
4	Franklin	2	.159
5	Hancock	1	.121
6	Kennebec	2	.159
7	Knox	2	.159
8	Lincoln	2	.159
9	Oxford	2	.159
10	Penobscot	1	.121
11	Piscataquis	1	.121
12	Sagadahoc	2	.159
13	Somerset	1	.121
14	Waldo	2	.159
15	Washington	1	.121
16	York	2	.159
	MARYLAND — 19		
—	All counties	1	.733
	MASSACHUSETTS — 20		
—	All counties	1	.556
	MICHIGAN — 21		
1	Alcona	1	.139
2	Alger	4	.138
3	Allegan	3	.410
4	Alpena	1	.139
5	Antrim	1	.139
6	Arenac	1	.139
7	Baraga	4	.138
8	Barry	3	.410
9	Bay	2	.324
10	Benzie	1	.139
11	Berrien	3	.410
12	Branch	3	.410
13	Calhoun	3	.410
14	Cass	3	.410
15	Charlevoix	1	.139
16	Cheboygan	1	.139
17	Chippewa	4	.138
18	Clare	2	.324
19	Clinton	2	.324
20	Crawford	1	.139
21	Delta	4	.138
22	Dickinson	4	.138
23	Eaton	3	.410
24	Emmet	1	.139
25	Genesee	2	.324
26	Gladwin	1	.139
27	Gogebic	4	.138
28	Grand Traverse	1	.139
29	Gratiot	2	.324
30	Hillsdale	3	.410
31	Houghton	4	.138
32	Huron	2	.324
33	Ingham	3	.410
34	Ionia	2	.324
35	Iosco	1	.139
36	Iron	4	.138
37	Isabella	2	.324
38	Jackson	3	.410
39	Kalamazoo	3	.410
40	Kalkaska	1	.139
41	Kent	2	.324
42	Keweenaw	4	.138
43	Lake	2	.324
44	Lapeer	2	.324
45	Leelanau	1	.139
46	Lenawee	2	.324
47	Livingston	3	.410
48	Luce	4	.138
49	Mackinac	4	.138
50	Macomb	2	.324
51	Manistee	2	.324
52	Marquette	4	.138
53	Mason	2	.324
54	Mecosta	2	.324
55	Menominee	4	.138
56	Midland	2	.324
57	Missaukee	1	.139
58	Monroe	2	.324
59	Montcalm	2	.324
60	Montmorency	1	.139
61	Muskegon	2	.324
62	Newaygo	2	.324
63	Oakland	2	.324
64	Oceana	2	.324
65	Ogemaw	1	.139
66	Ontonagon	1	.139
67	Osceola	2	.324
68	Oscoda	1	.139
69	Otsego	1	.139
70	Ottawa	2	.324
71	Presque Isle	1	.139
72	Roscommon	1	.139
73	Saginaw	2	.324
74	St. Clair	2	.324
75	St. Joseph	3	.410
76	Sanilac	2	.324
77	Schoolcraft	4	.138
78	Shiawassee	2	.324
79	Tuscola	2	.324
80	Van Buren	3	.410
81	Washtenaw	3	.410
82	Wayne	3	.410
83	Wexford	1	.139
	MINNESOTA — 22		
1	Aitkin	1	.125
2	Anoka	2	.324
3	Becker	1	.125
4	Beltrami	1	.125
5	Benton	2	.324
6	Big Stone	2	.324
7	Blue Earth	3	.371
8	Brown	3	.371
9	Carlton	1	.125
10	Carver	3	.371
11	Cass	1	.125
12	Chippewa	2	.324
13	Chisago	2	.324
14	Clay	1	.125
15	Clearwater	1	.125
16	Cook	1	.125
17	Cottonwood	3	.371
18	Crow Wing	1	.125
19	Dakota	3	.371
20	Dodge	3	.371
21	Douglas	2	.324
22	Faribault	3	.371
23	Fillmore	3	.371
24	Freeborn	3	.371
25	Goodhue	3	.371
26	Grant	2	.324
27	Hennepin	3	.371
28	Houston	3	.371
29	Hubbard	1	.125
30	Isanti	2	.324
31	Itasca	1	.125
32	Jackson	3	.371
33	Kanabec	2	.324
34	Kandiyohi	2	.324
35	Kittson	1	.125
36	Koochiching	1	.125
37	Lac Qui Parle	2	.324
38	Lake	1	.125
39	Lake of the Woods	1	.125
40	Le Sueur	3	.371
41	Lincoln	3	.371
42	Lyon	3	.371
43	McLeod	3	.371
44	Mahnomen	1	.125
45	Marshall	1	.125
46	Martin	3	.371
47	Meeker	2	.324
48	Mille Lacs	2	.324
49	Morrison	2	.324
50	Mower	3	.371
51	Murray	3	.371
52	Nicollet	3	.371
53	Nobles	3	.371
54	Norman	1	.125
55	Olmsted	3	.371
56	Otter Tail	1	.125
57	Pennington	1	.125
58	Pine	2	.324
59	Pipestone	3	.371
60	Polk	1	.125
61	Pope	2	.324
62	Ramsey	3	.371
63	Red Lake	1	.125
64	Redwood	3	.371
65	Renville	3	.371
66	Rice	3	.371
67	Rock	3	.371
68	Roseau	1	.125
69	St. Louis	1	.125
70	Scott	3	.371
71	Sherburne	2	.324
72	Sibley	3	.371
73	Stearns	2	.324
74	Steele	3	.371
75	Stevens	2	.324
76	Swift	2	.324
77	Todd	2	.324
78	Traverse	2	.324
79	Wabasha	3	.371
80	Wadena	1	.125
81	Waseca	3	.371
82	Washington	2	.324
83	Watonwan	3	.371
84	Wilkin	1	.125
85	Winona	3	.371
86	Wright	2	.324
87	Yellow Medicine	2	.324

Code	County	Degree-Hour Zone	Climatic Factor
	MISSISSIPPI — 23		
—	All counties	1	.919
	MISSOURI — 24		
1	Adair	1	.680
2	Andrew	1	.680
3	Atchison	1	.680
4	Audrain	1	.680
5	Barry	2	.740
6	Barton	1	.680
7	Bates	1	.680
8	Benton	1	.680
9	Bollinger	2	.740
10	Boone	1	.680
11	Buchanan	1	.680
12	Butler	2	.740
13	Caldwell	1	.680
14	Callaway	1	.680
15	Camden	1	.680
16	Cape Girardeau	2	.740
17	Carroll	1	.680
18	Carter	2	.740
19	Cass	1	.680
20	Cedar	1	.680
21	Chariton	1	.680
22	Christian	2	.740
23	Clark	1	.680
24	Clay	1	.680
25	Clinton	1	.680
26	Cole	1	.680
27	Cooper	1	.680
28	Crawford	1	.680
29	Dade	2	.740
30	Dallas	2	.740
31	Daviess	1	.680
32	De Kalb	1	.680
33	Dent	2	.740
34	Douglas	2	.740
35	Dunklin	2	.740
36	Franklin	1	.680
37	Gasconade	1	.680
38	Gentry	1	.680
39	Greene	2	.740
40	Grundy	1	.680
41	Harrison	1	.680
42	Henry	1	.680
43	Hickory	1	.680
44	Holt	1	.680
45	Howard	1	.680
46	Howell	2	.740
47	Iron	2	.740
48	Jackson	1	.680
49	Jasper	2	.740
50	Jefferson	1	.680
51	Johnson	1	.680
52	Knox	1	.680
53	Laclede	2	.740
54	Lafayette	1	.680
55	Lawrence	2	.740
56	Lewis	1	.680
57	Lincoln	1	.680
58	Linn	1	.680
59	Livingston	1	.680
60	McDonald	2	.740
61	Macon	1	.680
62	Madison	2	.740
63	Maries	1	.680
64	Marion	1	.680
65	Mercer	1	.680
66	Miller	1	.680
67	Mississippi	2	.740
68	Moniteau	1	.680
69	Monroe	1	.680
70	Montgomery	1	.680
71	Morgan	1	.680
72	New Madrid	2	.740
73	Newton	2	.740
74	Nodaway	1	.680
75	Oregon	2	.740
76	Osage	2	.740
77	Ozark	1	.680
78	Pemiscot	2	.740
79	Perry	1	.680
80	Pettis	1	.680
81	Phelps	1	.680
82	Pike	1	.680
83	Platte	1	.680
84	Polk	2	.740
85	Pulaski	1	.680
86	Putnam	1	.680
87	Ralls	1	.680
88	Randolph	1	.680
89	Ray	1	.680
90	Reynolds	2	.740
91	Ripley	2	.740
92	St. Charles	1	.680
93	St. Clair	1	.680
94	St. Francois	1	.680
95	St. Louis	1	.680
96	St. Louis City	1	.680
97	Ste. Genevieve	1	.680
98	Saline	1	.680
99	Schuyler	1	.680
100	Scotland	1	.680
101	Scott	2	.740
102	Shannon	2	.740
103	Shelby	1	.680
104	Stoddard	2	.740
105	Stone	2	.740
106	Sullivan	1	.680
107	Taney	2	.740
108	Texas	2	.740
109	Vernon	1	.680
110	Warren	1	.680
111	Washington	1	.680
112	Wayne	2	.740
113	Webster	2	.740
114	Worth	1	.680
115	Wright	2	.740
	MONTANA — 25		
—	All counties	1	.676
	NEBRASKA — 26		
1	Adams	2	.566
2	Antelope	1	.606
3	Arthur	3	.525
4	Banner	3	.525
5	Blaine	2	.566
6	Boone	1	.606
7	Box Butte	3	.525
8	Boyd	2	.566
9	Brown	2	.566
10	Buffalo	2	.566
11	Burt	1	.606
12	Butler	1	.606
13	Cass	1	.606
14	Cedar	1	.606
15	Chase	3	.525
16	Cherry	3	.525
17	Cheyenne	3	.525
18	Clay	1	.606
19	Colfax	1	.606
20	Cuming	1	.606
21	Custer	2	.566
22	Dakota	1	.606
23	Dawes	3	.525
24	Dawson	2	.566
25	Deuel	3	.525
26	Dixon	1	.606
27	Dodge	1	.606
28	Douglas	1	.606
29	Dundy	3	.525
30	Fillmore	1	.606
31	Franklin	2	.566
32	Frontier	3	.525
33	Furnas	2	.566
34	Gage	1	.606
35	Garden	3	.525
36	Garfield	2	.566
37	Gosper	2	.566
38	Grant	3	.525
39	Greeley	3	.525
40	Hall	2	.566
41	Hamilton	1	.606
42	Harlan	2	.566
43	Hayes	3	.525
44	Hitchcock	3	.525
45	Holt	2	.566
46	Hooker	3	.525
47	Howard	2	.566
48	Jefferson	1	.606
49	Johnson	1	.606
50	Kearney	2	.566
51	Keith	3	.525
52	Keyapaha	2	.566
53	Kimball	3	.525
54	Knox	1	.606
55	Lancaster	1	.606
56	Lincoln	3	.525
57	Logan	3	.525
58	Loup	2	.566
59	McPherson	3	.525
60	Madison	1	.606
61	Merrick	1	.606
62	Morrill	3	.525
63	Nance	1	.606
64	Nemaha	1	.606
65	Nuckolls	1	.606
66	Otoe	1	.606
67	Pawnee	1	.606
68	Perkins	3	.525
69	Phelps	2	.566
70	Pierce	1	.606
71	Platte	1	.606
72	Polk	1	.606
73	Redwillow	3	.525
74	Richardson	1	.606
75	Rock	2	.566
76	Saline	1	.606
77	Sarpy	1	.606
78	Saunders	1	.606
79	Scotts Bluff	3	.525
80	Seward	1	.606
81	Sheridan	3	.525
82	Sherman	2	.566
83	Sioux	3	.525
84	Stanton	1	.606
85	Thayer	1	.606
86	Thomas	3	.525
87	Thurston	1	.606
88	Valley	2	.566
89	Washington	1	.606
90	Wayne	1	.606
91	Webster	2	.566
92	Wheeler	2	.566
93	York	1	.606
	NEVADA — 27		
—	All counties	1	.075
	NEW HAMPSHIRE — 28		
—	All counties	1	.140
	NEW JERSEY — 29		
1	Atlantic	1	.546
2	Bergen	2	.549
3	Burlington	1	.546
4	Camden	1	.546
5	Cape May	1	.546
6	Cumberland	1	.546
7	Essex	2	.549
8	Gloucester	1	.546
9	Hudson	2	.549
10	Hunterdon	1	.546
11	Mercer	1	.546
12	Middlesex	2	.549
13	Monmouth	2	.549
14	Morris	2	.549
15	Ocean	1	.546
16	Passaic	2	.549
17	Salem	1	.546
18	Somerset	2	.549
19	Sussex	2	.549
20	Union	2	.549
21	Warren	1	.546
	NEW MEXICO — 30		
—	All counties	1	.320
	NEW YORK — 31		
1	Albany	2	.510
2	Allegany	2	.510
3	Bronx	3	.547
4	Broome	2	.510
5	Cattaraugus	2	.510
6	Cayuga	2	.510
7	Chautauqua	2	.510
8	Chemung	2	.510
9	Chenango	2	.510
10	Clinton	1	.140
11	Columbia	2	.510
12	Cortland	2	.510
13	Delaware	2	.510
14	Dutchess	2	.510
15	Erie	2	.510
16	Essex	1	.140
17	Franklin	1	.140
18	Fulton	1	.140
19	Genesee	2	.510
20	Greene	2	.510
21	Hamilton	1	.140
22	Herkimer	1	.140
23	Jefferson	1	.140
24	Kings	3	.547
25	Lewis	1	.140
26	Livingston	2	.510
27	Madison	2	.510
28	Monroe	2	.510
29	Montgomery	1	.140
30	Nassau	3	.547
31	New York	3	.547
32	Niagara	2	.510
33	Oneida	1	.140
34	Onondaga	2	.510
35	Ontario	2	.510
36	Orange	2	.510
37	Orleans	2	.510
38	Oswego	1	.140
39	Otsego	2	.510
40	Putnam	2	.510
41	Queens	3	.547
42	Rensselaer	2	.510
43	Richmond	3	.547
44	Rockland	3	.547
45	St. Lawrence	1	.140
46	Saratoga	1	.140
47	Schenectady	1	.140
48	Schoharie	2	.510
49	Schuyler	2	.510
50	Seneca	2	.510
51	Steuben	2	.510
52	Suffolk	3	.547
53	Sullivan	2	.510
54	Tioga	2	.510
55	Tompkins	2	.510
56	Ulster	2	.510
57	Warren	1	.140
58	Washington	1	.140
59	Wayne	2	.510
60	Westchester	3	.547
61	Wyoming	2	.510
62	Yates	2	.510

[Figures for the other states will be published next month.]

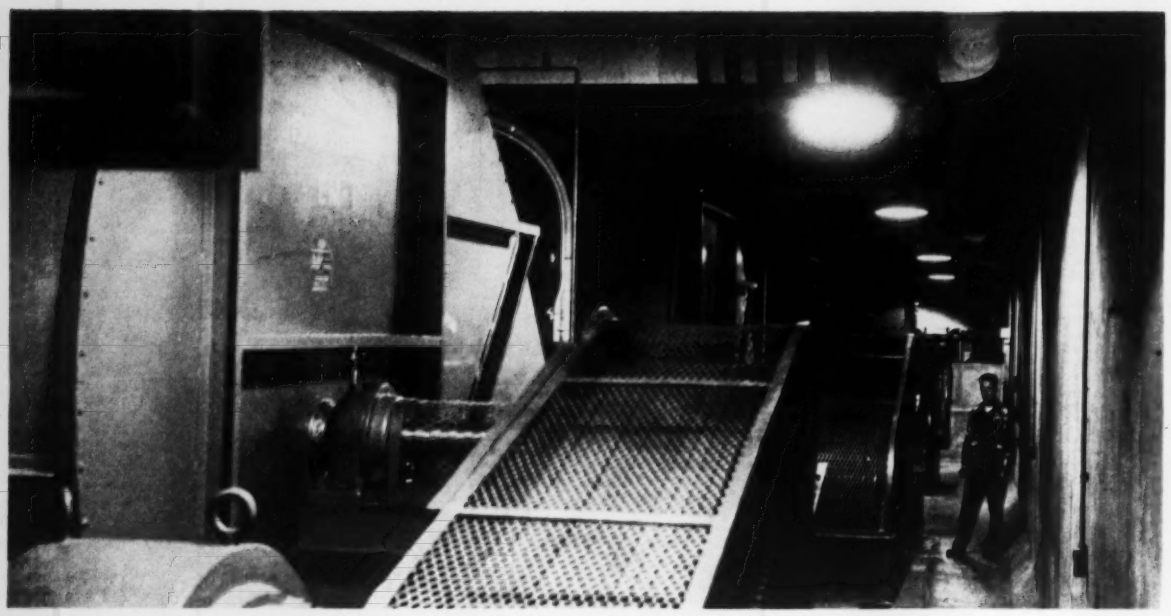


FIG. 1 — PART OF AN EXHAUST FAN BANK serving a process building. The construction of exhaust ductwork for radiological hazards requires careful attention to details and techniques

Constructing Ventilation Systems for Radioactive Work

By W. W. McIntosh

Mechanical Engineer
General Electric Co.
Richland, Wash.

CONSTRUCTING VENTILATION systems for buildings in which radioactive work is done is considerably more difficult than on the usual job. Unusually rigid requirements for quality of construction, the use of unconventional materials, the greater care required in layout, and adequate provision for controls are all problems which will be encountered and must be solved — in addition to those met in ordinary construction. Satisfactory execution of the work is dependent on having competent, experienced contractors, good field supervision and the full cooperation of the crafts involved.

CONSTRUCTION OF ventilation systems for plants and laboratories in which radioactive work is done involves more severe requirements than are normally encountered. There must be no pulsation or variations in air flows and pressures during operation; high-quality construction which will be failure-proof and (insofar as possible) tamper-proof is required; and unusually difficult construction in regard to fabrication details, such as surface finish of the interior of some exhaust components, is needed. Air-tightness of certain ducts and certain structural features is essential; in addition, such work involves the use of unusual materials and types of fabrication.

Design Must Be Followed Carefully

The contractor must, in many instances, accomplish his normal work with rather sketchily prepared drawings and specifications; consequently he has learned to rely on his own judgment and initiative to fill in the missing pieces in the design. This method of operation gets the job done, usually in a satisfactory manner, and is the only practicable method of operation for the contractor to adopt if he intends to stay in business on a profitable basis.

However, in complex structures in

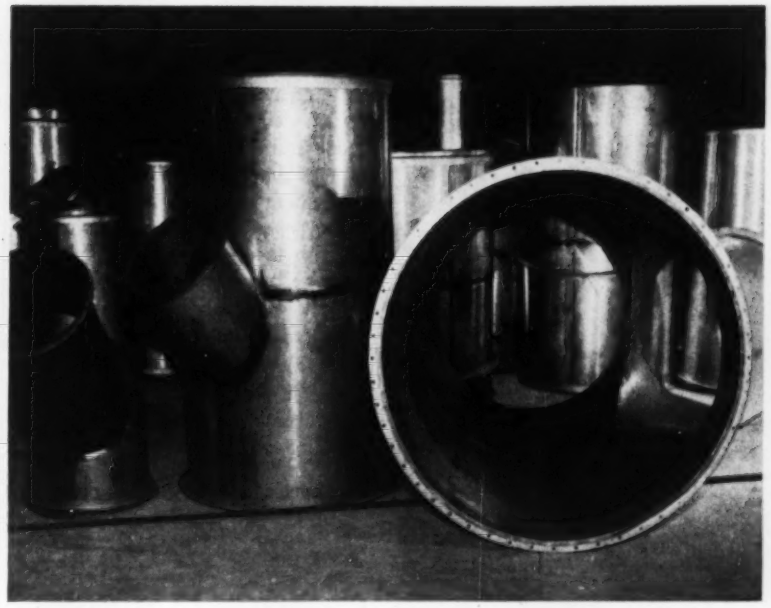


FIG. 2 — STAINLESS STEEL DUCT sections fabricated by welding with the inert gas shielded tungsten arc process. The large duct is about 5 ft in diameter

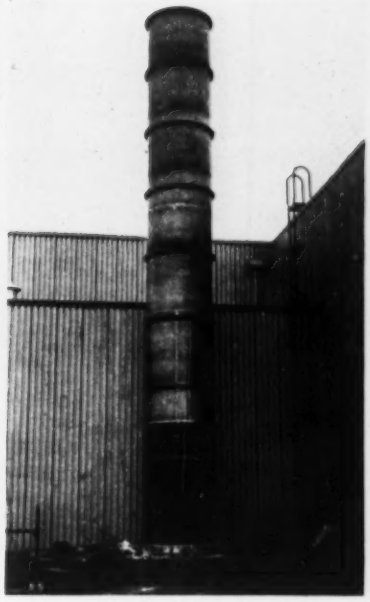


FIG. 3 — A WELDED ALUMINUM EXHAUST STACK for ventilation, downstream from the filters

which radiological hazards exist, a great deal more than the normal number and types of building services must be furnished. Designs for such buildings must be much more carefully developed, and allocation of space between the services must be predetermined on the drafting board. Construction under these circumstances calls for some revision in the methods of operation on the part of the builder. Layout of all the services — electrical, piping and ventilation — must be carefully supervised so that the original design intent is not compromised. This caution applies with particular emphasis to ventilation equipment and ducts.

In addition to the normal requirements for adequate supply and exhaust with proper temperature control, ventilation systems for atomic plants must also meet requirements for exceptionally steady operation, absolute metering of air quantities to and from all spaces, carefully controlled velocities and quantities through certain ducts and openings, guaranteed pitch of certain ducts, and unobstructed access to certain ducts and appurtenances. Thus, the contractor has the responsibility for working closely with the engineer to insure that field changes do not jeopardize requirements of the system which might not be recognized by the builder.

Good Ventilation Details Are Essential

Types of construction that represent good detail of ventilation system components are generally recognized in the trade. The need for adherence to good design of detail parts is more compelling in this work than in systems of more conventional types.

As mentioned above, every effort must be made to obtain steady, nonpulsing air flow in both the supply and exhaust systems. Most sources of flow disturbance can be eliminated by careful attention to details. Inlet ducts to fans should be carefully formed so as to distribute the flow of air uniformly across the entire cross section of the fan inlet connections. Elbows should be made with easy radii, or, better yet, with properly formed and rigidly constructed turning vanes. All transitions should be made with angles of divergent sides not greater than 15 deg, and preferably less. Dampers should be very rigidly constructed with no backlash between the blade and the shaft or between the shaft and the adjusting quadrant. Ducts should be heavily constructed and adequately reinforced, and should be further reinforced where required if panting or vibration is detected after the system is put in operation.

In systems where continuous operation is a requirement, it is customary to provide standby fans in parallel with the operating fans; normally, operation is rotated among the units so that at all times one is available for routine maintenance.

Multi-leaf louvered dampers are often used to isolate the non-operating unit from the remainder of the operating bank. Leakage of the dampers could result in considerable loss in bypassing of air back through the idle fan.

On the exhaust side, a definite radiation hazard might exist if it were not possible to close the dampers tightly on the idle unit during overhaul. It is quite obviously impossible to design and build a large louvered damper to be absolutely airtight, but it is also quite possible to fail to obtain nearly as efficient a closure as was designed into the damper if it is not properly assembled and adjusted. Care in this respect can frequently cut the leakage through a damper by as much as five times.

Good Shop Drawings Avoid Troubles

Most construction contracts involving projects of any magnitude

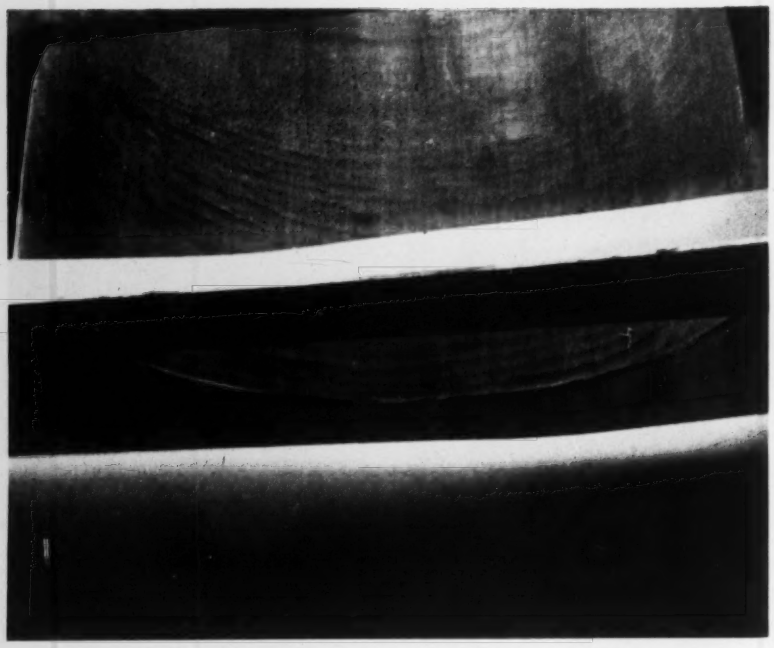


FIG. 4 — A FLAME-SPRAYED POLYETHYLENE COATING is used on the interior of this ventilation exhaust stack. The picture was taken from the breeching through the turning vanes

require shop drawings on all fabricated material. This requirement is a real safeguard for both the contractor and the engineer since it is the means by which misunderstandings or misinterpretations may be settled in advance, before large financial commitments have been made in actual fabrications.

Special requirements for interior finish and the use of unusual materials and fabrication methods raise questions of acceptability of detail construction features which will be shown on properly prepared shop drawings. Insistence on the submission of complete, detailed shop drawings, and their thorough review and approval before fabrication starts, is the best insurance available against claims for extras, controversy between the builder and the engineer, and delays in completion of the job.

Exhaust Systems Usually Corrosion Resistant

The supply side of a ventilation system for a building in which radiological hazards exist is usually constructed of conventional materials — galvanized sheet steel or aluminum. The use of these materials involves conventional problems of fabrication. The exhaust side of such a system requires special treatment to satisfy certain unusual requirements.

In general, exhaust systems must be corrosion resistant to the reagents which may be used in process or experimental work. They must be capable of being decontaminated; that is, they must be constructed of material which will resist decontaminating or cleaning solutions such as 10 to 20 percent nitric acid, detergents, etc. To make thorough cleaning possible, they must have a relatively smooth interior surface finish free from cracks, crevices, or inaccessible pockets. In addition, they often must be arranged to drain completely so that condensate or decontaminating solutions may be readily removed. Of course, the usual requirements for fire resistance and structural stability also must be met.

Welded Stainless Steel Meets Requirements

Stainless steel, fabricated by welding, has been found to meet the requirements for exhaust ductwork. Although its cost and scarcity impose serious handicaps on its use, no substitute has been discovered to completely supplant this material.

Conventional construction methods have, for many reasons, not been used to a large extent in stainless steel construction. They do not have the required corrosion resistance, or they create inaccessible crevices in which radioactive materials might lodge and from which they would be impossible of removal.

Welding stainless steel in the sheet metal gages can be accomplished only with the inert gas shielded tungsten arc process to yield the required quality of finish and corrosion resistance in the welded joint. This process has undergone remarkable development during the past few years in regard to application techniques.

Suggestions for Welding Stainless Steel Ducts

Fig. 2 shows samples of this type of work. The success of the process was achieved after long — and often painful — experience. Among the more important requirements are skillful operators thoroughly trained in the type of work being done; careful fit-up of parts; back purging (blanketing the back side of the piece being welded with inert gas) or backing the welded piece with a copper chill piece to prevent oxidization of the reverse side of the weld; and careful, thorough removal of all extraneous material from the joint prior to the start of welding.

A large number of other factors — such as welding speed, application of filler metal, type of electrode, rate of gas flow, current, etc. — are links in the chain of variables which determine uniform, acceptable results. A shop would be ill-advised to undertake this work without qualified operators, good equipment and experienced technical personnel to set up an adequate system of process control. In addition, there must be a willingness to make a substantial investment in time and money during the initial periods of production while techniques and procedures are being established.

Welding ordinary 18-8 stainless steel is affected by the phenomenon of carbide precipitation in the weld area. A very serious loss of corrosion resistance results unless measures are taken to counteract this effect. Solution heat treatment (heating to about 2000 F and quenching the entire weldment) will re-dissolve the carbon and eliminate the difficulty. But it is normally impractical

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to subject ductwork components to this treatment because of the cost, the unwieldiness of the pieces involved and the severe distortion which results in attempting to so treat weldments of light section.

The practical solution to this problem has been to use stabilized stainless steel, AISI type 347, or extra low carbon type 304L, with carbon held to 0.03 percent maximum. The former type has columbium as an addition in the proportion of about eight to ten times the carbon; this effectively eliminates carbide precipitation. The latter has carbon so limited in amount that its precipitation is not a problem. Due to the current scarcity of columbium, very little type 347 is available, except for welding rod; consequently, the 304L type constitutes the bulk of material now in use for this purpose.

The deleterious effect of carbon, in even very small quantities, creates a considerable problem in fabrication. Wire brushes, grinders and tools which might carry particles of carbon or carbon steel cannot be used in the preparation of joints for welding without subsequent operations to remove the carbon. Further, the welding of carbon steel components to stainless steel equipment, even on the opposite side of the material from that which is to be in contact with corrosive media, cannot be permitted due to the uncanny ability of damaging amounts of carbon to migrate through considerable thicknesses of the molten or heated material to the critical surface. This is true even with the use of stainless welding rod.

Aluminum Ducts Reveal Durability

Observation of a number of installations of aluminum ducts which have been exposed to a variety of ordinarily corrosive chemical vapors has revealed unexpected durability in this material. At the present time, one fairly large system is being installed in which all process exhaust ducts downstream of the radiological control filters are being constructed of aluminum with the inert gas shielded tungsten or metallic arc process of welding. Fig. 3 shows the exhaust stack of all-welded aluminum construction serving this facility. Stainless steel is used in all exhaust ducts between the sources of contamination and the radiological filters to withstand the effects of decontamination solutions.

Successful operation of this system may lead the way toward the elimination of a great deal of additional expense which is involved in the construction of the entire exhaust system of stainless steel.

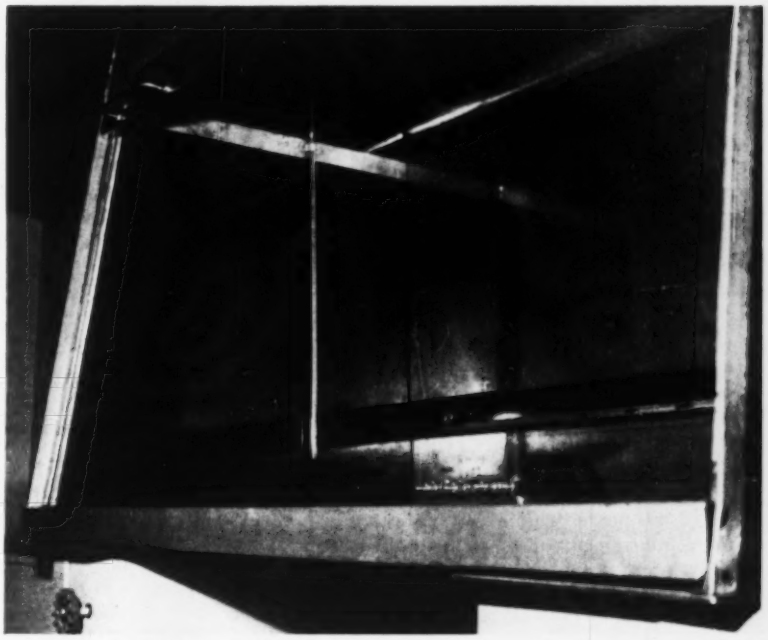


FIG. 5 — PRESSURE AND VELOCITY SENSING POINTS must be installed with care. This hood is equipped with automatic face velocity control. The interior pressure sensing tube is mounted on the side panel

Special Coatings Can Lead to Savings

The high cost of construction of stainless steel ducts has led to the use, in some applications, of a number of rather specialized coatings applied to carbon steel as a liner. In general, these coatings themselves are expensive and must be carefully applied; but on large ducts, plenums, etc., substantial savings can be realized by their use.

Special plastic paints have been used extensively and with notable success. These coatings require absolute cleanliness of the surfaces to which they are applied. This means, as a practical matter, that the steel must be either pickled or sandblasted just before the application of the first prime coat. From five to seven coats, preferably applied in alternate shades to insure complete coverage of each coat, are required. They may be applied by brush or spray and require somewhat special techniques to obtain satisfactory finish. With these coatings, the manufacturers' instructions must be carefully observed and some special instruction in their application is recommended.

Plastic and rubber coatings in sheet form are occasionally applied to the interior of ventilation components. This is strictly a job for experts and should be attempted only by those experienced in this work. Flame-sprayed polyethylene is another plastic coating which is suitable for severe service. The application of this finish is also a specialized process involving careful preparation of the surface before coating, and carefully controlled application techniques. Fig. 4 is a photo taken from the breeching of a flame-spray polyethylene-coated stack through the turning vanes. The smooth but slightly wavy surface of the lining may be observed on the far surface of the stack.

Gaskets and Sleeves for Exhaust Ducts

Exhaust ducts are normally made up of a series of sections welded together or of individual welded sections provided with flanged or sleeve

joints so that they can be dismantled. Flanges are commonly formed in one of two ways. One method is to use a flange of 1/8 to 1/4 in. thick stainless steel plate welded to the duct; the other and less expensive method is to flare out the duct material in the form of a flange and to provide back-up flanges of heavier carbon steel material. In either design neoprene gasketing has proved highly satisfactory. Polyethylene and other elastic, corrosion resistant plastic materials have also been used with success.

Sleeve joints are sometimes used in place of flanges. This type of joint is limited to round duct and is similar to the radiator hose used on your automobile. It is normally made of neoprene with vulcanized fabric reinforcement or is made of fabric reinforced rubber with a neoprene lining. These sleeve or hose connections are either cemented or clamped to the ducts with large size hose-type clamps.

Interior Finish for "Hot" Ductwork

It is frequently specified that the interior finish for "hot" ductwork (that portion of the exhaust ductwork which extends from the source of airborne radiological contamination to the high efficiency filter) be the equivalent of 2B mill finish. This finish normally falls in the range of roughness of from 10 to 20 microinches RMS [root mean square]. In some instances, the entire interior finish (including welds) has been required to meet this standard.

The cost of meeting this type of a specification is not small; consequently, less stringent requirements are adopted wherever possible. For "hot" ducts, about the minimum requirement which can be accepted is a finish which is smooth enough to be thoroughly cleaned by flushing or wiping. Waviness is not objectionable provided there are no sharp indentations or cracks from which minute particles or solutions could not be readily removed.

With welded construction, the very best techniques are required to give an acceptable interior finish without grinding or polishing. Complete and continuous penetration is required wherever welds are made from the outside. Abrupt convexity of the bead, excessive roughness, undercutting, craters or any other fault on the inside which would render the weld or the surrounding metal difficult to clean must be re-worked or otherwise finished to remove the defect.

It is often correctly pointed out that it is impossible to make a flanged or sleeve joint so perfect as to eliminate retention pockets. Excessive build-up of contamination in these joints can be removed, however, by disassembling and cleaning the metal surfaces and replacing the gaskets or sleeves.

Install Pressure, Velocity Sensing Points With Care

In addition to the usual temperature controls, a rather complicated system of pressure and volume controls may be employed in this work. The proper functioning of controls is dependent on the location of pressure sensing and velocity sensing devices. The control manufacturer should be brought into the picture early, before the ductwork layout is completed, and satisfactory arrangements should be made to meet the requirements of the control system in regard to the location of sensing points.

The points at which pressures may be sensed most accurately are not always predictable. Fig. 5 shows a pressure sensing tube installed in a hood for face velocity control. Pressure must be sensed in this instance to an accuracy of better than plus or minus 0.001 in. WG. The original location of the sensing tube near the top of the hood was found to yield inconsistent results. The location shown was the one finally adopted after considerable experimentation, and gives excellent results.

Static pressure sensing points in ducts or plenums must be arranged to compensate for velocity effects. Where flush sensing points are installed, care must be taken that the inner surface of the duct is smooth and that the sensing hole is absolutely flush, smooth and without burrs. Preferably, such points should be located in a straight section of duct with the air flow as undisturbed as possible by bends or branches upstream of the sensing point. Similar precautions in regard to location should be taken in the case of velocity sensing points.

Careful Inspection and Testing Needed

Inspection to assure acceptable quality of workmanship and materials will require more than normal effort — especially for the exhaust system. Proof of compliance with specifications should be required for all material finished in the case of stainless steel. Mill heat numbers, as marked on the material being fabricated, and certified chemical analyses of heats are normally sufficient evidence. Shop inspection by qualified welding inspectors is required to determine that the material is not damaged in process by poor techniques. A good deal of judgment is necessary in passing on the acceptability of interior finish, since it is difficult to describe this requirement in words.

Pressure tests are not normally specified for exhaust systems — even the "hot" ones. A very careful visual examination, along with smoke gun tests at the joints while the system is in operation, will usually suffice. Normal inspection for compliance with drawings and specifications applies, but special emphasis should be given to the construction details previously discussed to make sure that nothing in the construction of the system will contribute to pulsations or irregularity of air flow, which would cause difficulty later in balancing and in obtaining proper control.

[In the May HPAC, Mr. McIntosh wrote on the design of ventilation for process plants and laboratories presenting radiological hazards.]

BOOKLET EXPLAINS ENGINEERING PROFESSION

A BOOKLET ENTITLED Engineering — A Creative Profession has been published by the Engineers' Council for Professional Development, 29-33 W. 39th St., New York 18.

The new publication, comprising 32 pages, has brief sections on what engineering is, engineering work, the engineer, what an engineer must know, how engineers are educated, how an engineer progresses, and civil, mining and metallurgical, mechanical, electrical, and chemical engineering. There is also a section on choosing a college, and a two page bibiliography.

Single copies are available from the ECPD for 25c.

QUESTION OF THE MONTH

PROTECTING SNOW MELTING PIPING AGAINST CORROSION

THE QUESTION OF the Month published in the April HPAC about protecting snow melting piping against corrosion should probably be extended to include radiant heating installed in concrete slab floors. Experience in Canada during the last seven years has included the following episodes:

Case 1—A radiant heating system in a printing plant, consisting of pipe installed in a grade level slab, began to lose pressure after two years of service. Shortly after this was noticed, a wet spot appeared on the plant floor. The concrete was broken up over the wet area, and the pipe exposed.

Intense corrosion had taken place over the exterior lower surface of the pipe, for half its circumference, leaving it paper-thin and with many pinholes.

The corrosion was restricted to only one pipe, and for a distance along it of approximately 5 ft. Indications were that a small leak had developed initially, and the escaping water kept the pipe wet. The moisture promoted electrolytic corrosion, which quickly destroyed the pipe.

It was impossible to determine whether the initial leak was due to a defective length of pipe or to intense local corrosion. We did discover, however, that the 6 in. crushed stone under the piping ran thick and thin, because of irregular grading — and it was particularly thin under the destroyed section of pipe.

As a result, we developed a theory about this case — which may or may not be correct. It is that a network of pipe or tubing, laid over any material at ground level, develops a potential difference relative to the ground which causes a slow flow of current. If the material beneath the network has a relatively constant resistance, the current flow will be dissipated over the entire network.

Conversely, if the material beneath the network varies in thickness (that is, resistance), the current will concentrate at the point of least resistance, and the resulting intense current flow will cause very rapid corrosion.

Rule 1—The stone fill should be as nearly constant in thickness as possible.

Case 2—A floor-slab-on-grade radiant heating system was installed in the garage used by an undertaker. In two years, leakage became so great that the system was shut down.

The concrete floor was broken up in several places, and at all points the pipe was severely corroded — again on the lower exterior surface for half the circumference.

It was found that the system had been installed on sand (in place of the usual stone), and the sand was slightly corrosive. The type of corrosion was electrolytic.

At that stage, it was realized that undertakers' limousines are washed daily; therefore, the slab was always wet. Thus, electrolytic corrosion of the pipe was constantly encouraged.

Rule 2—Do not use sand as fill under piping, unless it is covered with a layer of stone which will allow water to drain away from the pipe.

Case 3—After three years' service, a slab-on-grade system in a bus station developed a leak, which was finally located in the floor of a washroom. The washroom was above a storage room; therefore, the underside of the slab was exposed to air.

The floor was broken up and the defective pipe section removed. As in the other cases, only the bottom half of the pipe was affected, and there was one hole about 1/16 in. in diameter among considerable pitting.

It was decided that there had been a scale inclusion in the steel, which had broken down and washed out.

Rule 3—Make sure that systems are hydrostatically tested, and keep the pressure on as long as possible.

Case 4—A number of leaks developed in a radiant system in a truck garage after two years of service. Inspection of the floor disclosed that the concrete thickness over the piping varied from 4 in. to zero. Some pipes were actually flush with the top surface of the slab.

During the winter, trucks brought a great deal of snow and ice into the garage, and this material contained calcium compounds, which corroded the pipe in the floor.

Rule 4—Specify a minimum thickness of concrete over pipes (3 in.).

Case 5—A portion of a snow melting system in a sidewalk was taken up after three years. The system had been carefully installed over a 6 in. crushed stone fill, and it had been thoroughly tested before covering. (Incidentally, the section had been taken up because of curiosity only — there were no leaks).

The pipe was in excellent condition, but very slight corrosion had begun to show on the botton half. Presumably, the same process was taking place as in the other cases.

Rule 5—Coat the piping with a good grade of asphalt paint or other protective coating before pouring concrete.

—W. A. CONNOR, Manager, Boiler Sales, John Inglis Co. Ltd. Formerly, Radiant Heating Engineer, Page Hersey Tubes Ltd.

ASKS FOR HELP ON REMOVING SCALE FROM BUILDING PIPING SYSTEM

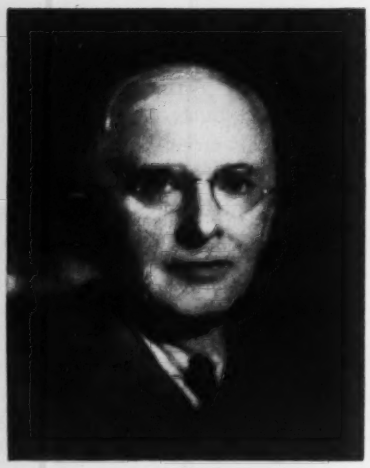
"Scale has clogged up the piping in one of our buildings to the extent that the flow of water is severely restricted. I wonder if there is a chemical or a cleaning method which would dissolve the scale and clear out the piping system without pieces of scale obstructing valves, traps, etc?

"I would appreciate comment from other operating men who have had this problem — particularly if they can tell me how to solve the difficulty." —J.W.

[You are invited to answer or comment on this question for publication here. Please address your remarks to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.]

SAM LEWIS

Describes Design for Coal Fired Plant



SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems. He recalls here the heating of his boyhood home with old fence rails and some of the same coal to be used in a plant he is designing to serve a campus. It will burn some 3000 tons annually

ANYONE CAN INSTALL a grate with an air inlet under it for air supply, and provide a chimney to dissipate the products of combustion. Anyone can ignite wood or coal above the grate and can keep throwing additional fuel on the fire.

When I was a boy in the country, my father's house was one of the few that had a basement and a warm air furnace. This furnace would take wood pieces up to 4 ft long. On a big farm there is frequent replacement of fence rails. These rails almost invariably were at least 12 ft long, split with steel wedges from large oak logs after the manner of Abraham Lincoln.

It was too much of a job for me to cut these old rails into three pieces, but I would stick an end of a rail into the furnace and let it burn off — returning to the cellar after a time to repeat the performance and to reassure myself that the burned off ends were not starting to set fire to the house. Fortunately, the oak rails, generally triangular in section and partly rotted (else they would not have been superseded) would not burn without a direct and potent draft.

We Had Our Own Strip Coal Mine

When the supply of old fence rails became exhausted, we would go to a ravine in the back end of the farm near the river, with a team of horses and a slip scraper, and would uncover our own strip coal mine. The vein of coal was about a foot thick, under perhaps a hundred feet of earth, except where the erosion of the centuries had exposed it in the bottom of the ravine. We used to burn perhaps 35 tons of this bituminous Illinois coal each year.

Now I am designing a heating plant to burn about 3000 tons of this same coal annually and to distribute the heat from it to a whole campus-ful of educational buildings.

A Plant To Burn 3000 Tons a Year

We will use steam at about 100 lb pressure in several tall boilers made of steel — mostly tubes full of water and arranged so that the water circulates rapidly around the combustion chamber and so that the tubes act like haircombs to strain out some of the heat. The coal is stored in underground bunkers over the top of which the trucks drive, and the coal is moved mechanically into the hoppers of the stokers. The ash and clinkers are removed by pneumatic conveyors and lifted into a circular, well-vented storage bin, from which it falls into trucks.

The volume of coal delivered and the air for burning it are proportioned automatically under supervision of instruments. The fly ash that might bring complaint from the laundresses of the neighbors is separated and is returned to the combustion chamber without air-turmoil, for fusing into clinker. The dissolved solids in the feedwater that might be precipitated to form scale in the boiler tubes are removed before the treated water is forced into the boilers — though in this heating system practically all of the condensate is regained and the only new water admitted is that required for replacing the relatively small amount lost through valve glands and air vents.

Steam Will Heat Water for Heating Buildings

In various departments through the many buildings it is planned to employ water for heating. The necessary heat transfer is accomplished by copper water tubes surrounded by the steam. In most cases the water, at thermostatically controlled temperatures, then is circulated by electric centrifugal pumps.

Savings in fuel have been made when the temperature of the heat transmitting medium is varied in proportion to the need. I like to select a heating system with this characteristic.

ELECTRIC ASSOCIATION SPONSORS A.C. SHOW

THE ELECTRIC ASSOCIATION of Chicago, in cooperation with Commonwealth Edison Co. and the distributors of 13 brand name products, is currently sponsoring an air conditioning show in the Edison building at 140 S. Dearborn St.

On display are more than 50 air conditioners, ranging from window units for a single room to "package" units for the whole house. Supplementing product displays are several exhibits and entertainment and variety features.

The Contractor's Responsibility Under Plans and Specifications

THE CHARACTERS IN our little drama this month (names disguised) are Holder & Holder, property owners; T. Squair, their architect; E. Rector, general contractor; Flow Corp., heating engineers; and the Telluric Temperature Co., heating contractors.

In May 1948, the Holders contracted with E. Rector to build a structure (in a southwestern state) for them "according to plans and specifications prepared and furnished" by their architect, Mr. Squair. These had been paid for by the general contractor, Rector, and the sum — added to the building's cost — was charged to the owners.

Before the structural work was started, the Holders awoke to the fact that no heating system had been included in the plans, specifications or contract. They consulted Squair respecting the best type of system. Upon being told to go ahead, he in turn consulted the Flow Corp., which at his request drew up plans and specifications for a heating system and mailed them to Rector. Like the cost for the building's plans, these were also added to the sum of the cost-plus contract.

Rector then sublet the heating job to Telluric, adding the figure to the cost. Telluric agreed to furnish all materials and perform all labor required by the heating plans and specifications as supplied by the heating engineers. (Bear in mind that there had been no direct contact between the owners of the property and the heating engineers, or between the owners and the heating contractors.)

Failed To Supply Adequate Heat

When everything was completed, the heating system failed to supply adequate heat. Holder & Holder complained to Rector and Telluric, but the system could not be made to meet the owners' demands. Thereupon, Holder & Holder sued Rector (the general contractor) and Telluric Temperature Co. for substantial damages, alleging "breach of contract and warranty". Flow Corp. was also made a party defendant.

The trial court, sitting without a jury, decided against Holder & Holder, who appealed to the state's supreme court. That tribunal went into the several relationships involved.

To begin with, the higher court found "no contractual relationship" between the property owners and the heating engineers, nor any "privity of contract" between them. That let Flow Corp. out, insofar as liability to Holder & Holder was concerned.

Respecting the physical merits of the suit, Holder & Holder contended among other things that the filler between the pipes should have been thoroughly dried pea gravel instead of the pumice used by Telluric. Pumice, in the Holders' opinion, was not a proper material.

In regard to this and similar criticisms, the higher court found from the evidence "that the subcontractor submitted his bid based on a copy of the plans and specifications prepared by Flow Corp. at the request of T. Squair, Holder & Holder's agent-architect, and delivered to Telluric by the general contractor."

Furthermore, the specifications called for *either* thoroughly dried pea gravel *or* loose pumice. According to the higher court's reasoning, the subcontractor was thus given the option of either pea gravel or loose pumice. Hence the use of either would be in compliance with the contract. The trial court had found that the *heating* contractors complied with the written contract as furnished them by the *general* contractor and that they installed the system "according to the plans and specifications prepared" by the heating *engineer*.

The higher court opined that the only duty resting upon the general contractor and the subcontractor was to perform the required work and furnish the material in accordance with the plans and specifications given each for the purpose of submitting a bid. "This is exactly what they did," said the court.

We have here a (1) general contractor furnishing plans and specifications to (2) a subcontractor, which plans in turn were prepared by (3) a heating engineer at the request of (4) the owners' architect and handed to the general contractor by that architect, who according to the court was acting as the owners' agent.

Useful Definition of a Subcontractor

At this point, the higher court supplied a useful definition: "A sub-

[*Concluded on page 107*]

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

Piping Changes Improve Lubrication

By C. T. Baker, Consulting Engineer

TWO OF THE MANY cases in my engineer's notebook involve problems having to do with lubrication and oil contamination — and how piping changes corrected the operating difficulties.

The Case of the Groaning Cylinder

Although the mechanical lubricator pumped oil in quantities greatly in excess of those which would normally be required to lubricate the wearing surfaces of the cylinders and valves, it was difficult to lubricate a certain Corliss non-condensing, single expansion engine. However, in addition to the lubricating problem, there was also the matter of oil in the hot well condensate which was used as boiler feed.

To insure more complete atomization, the lubricating oil was introduced into the steam supply line to the engine as shown in Fig. 1. A trough had been formed by cutting the tube on a slant — approximately a 50 deg angle — and the steam, in its downward flow, struck the trough, causing the oil to be well broken up before it reached the engine cylinders. This method of conducting lubricating oil to steam engine valve chests and cylinders is one that has proved highly satisfactory. It is not a recent practice — plant engineers have been using the system for years.

There is, however, both a right and a wrong way of doing this — as will be noted on the sketch, and in my explanation. In the case here discussed, the oil was introduced above the oil separator, necessitating passage through the separator before it reached the cylinder. Under such a condition, it follows that a portion of the oil will separate from the steam with the condensate, pass into the trap, and then, along with the water, be discharged to the hot well.

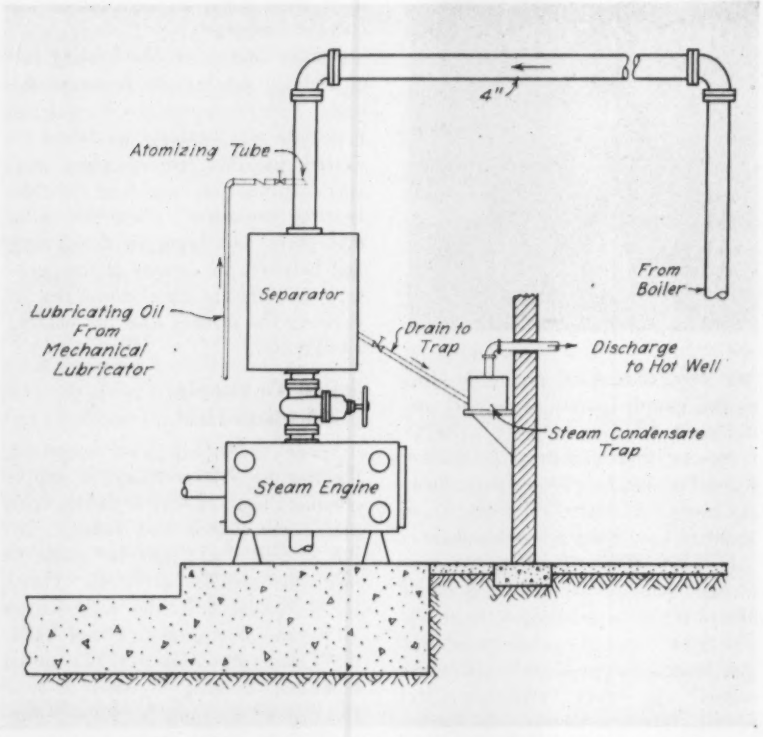


FIG. 1—BY RAISING THE SEPARATOR to the flanged elbow and placing the oil feed connection immediately below the separator, it was possible to retain the advantages of the atomizing tube without impairing operation of the separator

By raising the separator to the flanged elbow and placing the oil feed connection immediately below the separator, it was possible to retain the advantages of the atomizing tube without impairing the operation of the separator.

Following these changes, the hot well and the open type feedwater heater were thoroughly cleaned and no trouble has since been experienced with oil in the condensate.

The lubricating problem has also disappeared. Complete lubrication is now possible and results are very satisfactory even though only a small percentage of the oil formerly introduced is now being used.

The Case of the Oil-Contaminated Condenser

A 250 kw engine generator set, operating at 225 rpm, exhausting into a steam condenser at 26 in. of vacuum, delivered all of the lubricating oil to the condenser, rather than to the trap that drained the separator in the exhaust line provided to remove cylinder oil before the exhaust steam reached the condenser. The condenser and the exhaust piping

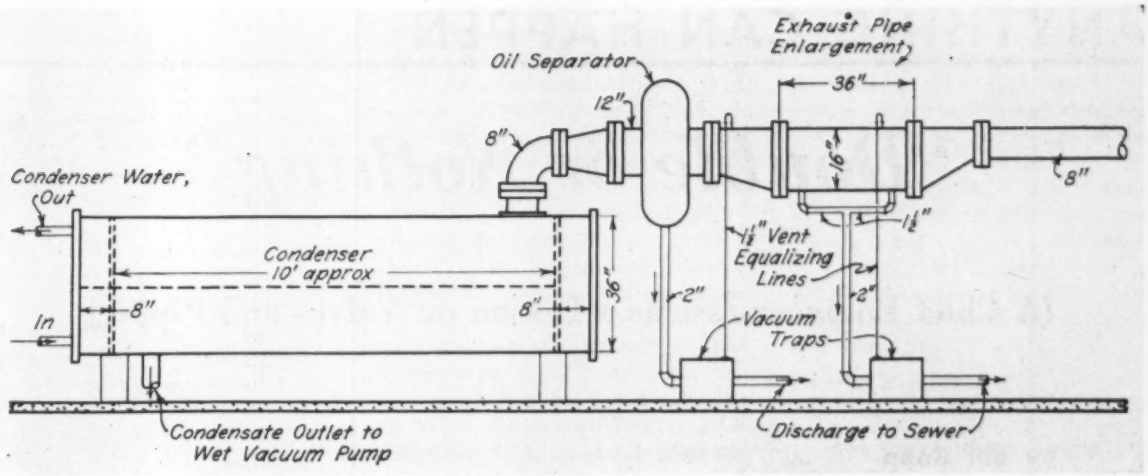


FIG. 2—A LARGER SEPARATOR WAS NEEDED, but space limitations restricted the choice to the nominal 12 in. size. The piping arrangement sketched here solved the problem

were located in a pit where space was limited — little opportunity was left for making changes in the exhaust line. However, something had to be done to prevent the condensate leaving the condenser from being contaminated with lubricating oil, as it was important that this condensate be available for boiler feedwater.

It was evident — after an examination of the layout — that the oil separator was too small; it failed to provide sufficient cross-sectional area to reduce steam velocities to the point where the oil could separate from the exhaust. This meant that a larger separator must be installed, but because of space limitations, we were restricted to the nominal 12 in. size, with flanges reduced on the downstream side to permit connection of the 8 in. exhaust line. On the inlet side, there was sufficient room to install a 16 in. diameter by 36 in. length of pipe, drilled and tapped at each end for drain connections. The drain connected to a vacuum trap which discharged to the sewer the oil and condensate collected, as shown in Fig. 2.

The combined effect of this change was to reduce the velocity of the exhaust steam to the point where satisfactory removal of the oil was accomplished. Within a very short time lubricating oil ceased to show up in the condensate — which meant that the condensate was perfectly safe for boiler feed.

THE LAW —

[*Concluded from page* 105]

contractor is one who has entered into a contract, express or implied, for performance of an act with a person who has already contracted for that performance."

Either a general contractor or a subcontractor, according to the court, can rely upon specifications given them for the purpose of submitting a bid. Rights of parties as to contract are to be measured and determined by the particular set of plans and specifications so given. In the present case, the owners' agent-architect caused the plans and specifications for a heating system to be prepared. These, as we have noted, were furnished to the general contractor, Rector, and the heating subcontractor, Telluric — who submitted his bid on the basis thereof.

"Where a building contract refers to plans and specifications and so makes them a part of itself, the contract is to be construed as to its terms and scope *together with* the plans and specifications", says the supreme court. In this ruling there is ample precedent. As one example, a building contractor, in another state, being obliged to follow plans and specifications furnished as his guide by the architect-agent of the owner, was held to be not responsible for the collapse of basement walls. Blame for this catastrophe was laid to the architect's failure to design walls sufficiently strong to stand on low and wet ground.

In the case of Holder & Holder, the state supreme court went further. Sustaining the trial court's judgment in the general and subcontractor's favor, the higher tribunal ruled that if there was an "implied warranty of sufficiency", it was made by Holders' agent-architect, who approved the heating plans and specifications prepared at his request.

In calling for proposals to produce a specified result by following them, the agent-architect — not the heating contractor — warranted those plans and specifications to produce such result. The *responsibility* rests upon the party who fathers the plans and specifications and presents them to another with the implied representation that they are adequate for the purpose intended. Granting that Holder & Holder were damaged, both courts held that the fault lay not with the general contractor, heating subcontractor or heating engineer, but with the owners' "so-called architect" — to use the judge's exact language.

This case points up the advantage of bidding upon plans and specifications drawn up by engineers. On the other hand, it likewise teaches caution in going ahead with plans and specifications that may breed controversy when carried out, even though the contractor or subcontractor may be relieved of legal responsibility.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

ANYTHING CAN HAPPEN

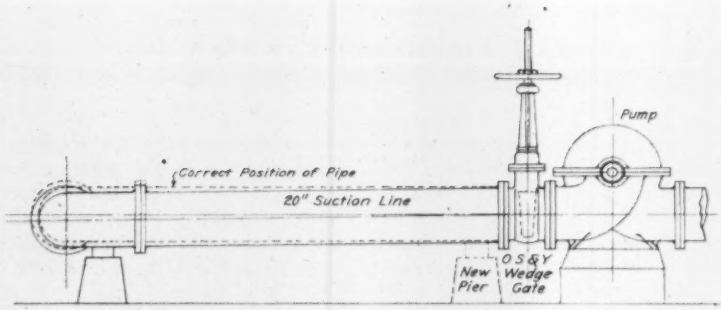
"Double or Nothing"

(A Chief Engineer Learns a Lesson on Valves and Piping)

By Bill Dopp

• *Almost anything can happen when you're in the engineering, operating, contracting or sales ends of the heating, piping and air conditioning industry. The objective of this more-or-less regular editorial feature in HPAC is to discuss practical problems that need solving — and ways to solve them.*

Bill Dopp has had 40 years of experience dealing with piping and including a long stretch of service as a sales engineer. He is devoting some of his present leisure to drawing on his many piping experiences, as he does in this story.



"DID YOU MAKE any provision for taking the pipe line strain off the valve and pump?", asked Mac

"WHY DON'T THEY make good valves any more?," asked Buck Hanson of Martin MacVane.

"Who says they don't?," asked Mac.

They were sitting in Buck's office at the brewery. He is the chief engineer and Mac is a packing salesman with a lot of know-how.

Buck has some pretty firm convictions. "I say they don't," he replied.

"You're jumping to conclusions again," said Mac.

"I'm not shooting wild," Buck objected. "I'm having a lot of trouble with valves these days. Brand-new ones, too."

"For instance?," asked Mac.

"Well, take that twenty inch gate in the suction line to the new circulating pump. We shut down over the weekends, you know."

"Yes, I know," admitted Mac.

"That whole installation is new. Saturday nights we close that valve to prevent the condenser from draining back through the pump. No matter what we do, that valve still leaks. The valve company has sent a shop man down here twice to lap it in, but in a couple of weeks it's leaking just as bad as ever."

"What kind of a valve is it?," asked Mac.

"An O S & Y wedge gate. It's a standard 125 pound valve, too. Just like the one on the outlet side of the condenser."

"Let's go down and take a look at it," Mac suggested.

The resonant laugh of the brewery engineer rang out as he jibed his salesman friend. "I suppose you've got X-ray eyes and can look right into the valve and tell what the trouble is."

"Might be," Mac chuckled. "Let's go."

He got up and Buck followed him. Down to the basement they went.

"Here's your valve. Can you see through that?" Buck said, as they reached the lower level.

Mac slowly sized up the situation. The valve stood upright, bolted against the pump. A 12 ft length of cast iron pipe was next to the valve and a big long sweep elbow was bolted to that. The ell appeared to be resting on a concrete pier. Then there was about 20 ft more of this heavy pipe and another ell turning down into the suction well — the pipe near the well being supported on another pier.

"Buck, why did you choose a wedge gate?," Mac asked, looking at his friend inquiringly.

"Because that's the best valve. When good valves were made you never had any trouble with a wedge gate. But I've had plenty of trouble with the other kind. I've had double disc valves stick so tight that dynamite wouldn't open them."

"Sure you have. So has nearly everybody else. That doesn't prove anything, except maybe ignorance."

"What do you mean, ignorance?," demanded Buck.

"People do install valves in the wrong places," observed Mac.

"I suppose this is one of them?," asked Buck, with a bit of sarcasm in his voice.

"That's part of your trouble. But there's something else, too." Mac walked along the line. "You've got a drainage gradient in this suction pipe, I suppose. About half an inch to ten feet, isn't it?"

"Just about that." Buck was all attention now.

Piping Strain on Valve and Pump

"Did you make any provision for taking the pipe line strain off the valve and pump? That pipe is pretty heavy you know. Wonder if that ell is actually resting on the pier?"

"You're suggesting that the valve is actually supporting this heavy pipe?" Buck was beginning to see the light.

"Sure is," said Mac. "You're unquestionably distorting that valve body. The strain opens up the top at the bonnet opening and pinches the bottom. All the lapping in the world won't stop that valve from leaking. You'll have to do something about that pipe line strain first. There's where a double disc valve would help, since the discs would probably adjust themselves to the changing shape of the body. The strain wouldn't do that body any good, either."

"I can see now where the trouble is," said Buck. "But how can we fix it without tearing out the whole thing?" He was getting really worried now. "That pipe should have had a slight angle cut taken off the face of the flange next to the valve, shouldn't it?"

"Precisely," replied Mac. "You could put a wedge gasket in there, though it's a nice trick to build up one of those. I suggest you put a support under the pipe near the valve. Then drive a wedge under the ell until you have relieved the pipe strain. Forget the drainage factor. It's not important here, anyway."

"We'll get going on that right now," declared Buck. "I'll meet you back at the office."

While Buck was dishing out orders to lift the suction pipe, Mac wandered slowly back upstairs. When he got to the office, Buck greeted him: "Thanks a lot for your help. You've saved us a lot of trouble." He accepted the cigar Mac offered him. "You know I don't smoke, but I'll take it for that son of mine."

"Now tell me more about why you object to a wedge gate down there at the pump. I've always thought that the wedge gate valve was the better valve," said Buck.

"It is for many purposes," Mac replied. "But you are handling cold water. The double disc valve is primarily a water valve. You can't use it where the temperature goes over 250 degrees without danger of getting it tied up."

"You mean stuck, of course. Well, I had one that was really stuck. It was in a low pressure steam line. That valve was stuck so tight we had to shut down to get it open. Funny thing was that when we took off the bonnet the parts came out without any trouble. We replaced it with a wedge gate and have had some peace of mind ever since."

"That was the answer to that trouble, all right," said Mac, "but you can't rule out the double disc valve on that account. You had probably closed the valve when it was cold. Then the internal parts heated up. They got hotter than the body because there was less heat loss. It was the expansion of the discs and spreader that caused it to lock."

"When it cooled everything was all right again," said Buck, deeply interested now. "I see that. But why not always use a wedge gate, then?"

"For the very reason that has caused your present trouble. Low pressure water piping is usually heavy — made of cast iron, and flanged at that. Then, too, it is often poorly supported. That causes piping strain and distorts the valves in the line."

Heavy Equipment Doesn't Correct Poor Engineering

"We put a 125 pound valve in the line to be sure it was heavy enough." Buck was on the defensive now.

"Heavy equipment never makes up for poor engineering," declared Mac. "One of the surest ways to do poor engineering is to draw general conclusions from a particular incident. The double disc valve was designed for water. Both discs come in contact with the seating surface. If there is dirt or sediment in the water it will surely get on the seats. The movement of the disc tends to wipe the seat on the downside clean. Then, by forcing the discs straight up against both the seats, one of them will nearly always be tight. There is another factor you must take into consideration. When your wedge disc valve was closed it had only the head of water in the condenser against the disc."

"What's that got to do with it?," demanded Buck.

"Just this," answered Mac. "That valve was factory-tested to be tight at 125 pounds. Now, a wedge disc valve does not depend entirely on the wedge to get a tight seat. When pressure is applied to one side of the disc it forces the disc up against the seat ring on the downside and that alone will often be enough to keep the valve from leaking. But you have only a low head to put pressure on the disc. Many wedge gate valves will leak when they are used at pressures lower than they were designed and tested for."

Use the Right Valve for the Service

"Mac, you're telling me something brand-new — I've never heard that before. It explains, too, some of the other troubles I've had. I suppose the valve people would wring your neck for telling people this?"

"You're wrong there, Buck," Mac said. "The valve makers would give a lot to find a way to get engineers like you to realize that when they make a valve for a certain pressure they expect it to be used for a pressure somewhere near that. And a water valve is for water. That's what it's made for."

Buck was laughing now. He always enjoyed Mac's little lectures and learned a great deal from his experience. "It's a case of double or nothing then," he said. "I suppose I'll have to change that valve."

"No, just take the pipe strain off. Be sure you close the valve tight and you will be all right. We often get along with something that is not the best thing for the service. Your valve should be okay for a long time."

Mac got up to go. "Of course a double disc valve is easier to close tight than a wedge disc valve, especially in the larger sizes."

"Thanks, old top for your help and the education. I do appreciate it."

"I know you do, so no thanks are necessary. I'll give you a bit of home work though. Next time I come you tell me how you know when a gate valve is actually closed." Mac waved his hand in farewell greeting. "No, save it for next time. Goodbye now."

"Goodbye," called Buck after the retreating salesman. As Mac disappeared, he muttered under his breath, "Now, how *do* you know when a gate valve is closed?"

DATA SHEET

Simple Analysis Indicates Saving or Profit Due To Air Conditioning

A QUICK AND SIMPLE investment analysis technique has been developed to determine in dollars and cents how much the installation of air conditioning can help boost the sales and income of stores, restaurants and similar places of business. The technique can also be used by office and industrial employers to find out how air conditioning can save them money through increased efficiency.

The analysis also shows how many years it will take for the air conditioning to pay for itself.

The information is reproduced here through the courtesy of the Air Conditioning Div., General Electric Co.

HOW TO FIGURE SAVING DUE TO OFFICE AIR CONDITIONING

Average hourly wage rate ..... $.....

If in hot weather each employee loses one hour per day in efficiency (7½ minutes per hour—an extra trip for a cold drink—an extra chat about how hot it is!), the saving per employee per day with air conditioning is one hour's pay .....

Number of employees ..... X———

Daily saving with air conditioning .....

*No. of working days requiring air conditioning X———

Extra gross saving with air conditioning .....

Operating Cost (estimated)
Electricity and water $.....
Maintenance +———
Total ..... ———

Extra net saving with air conditioning .....

INVESTMENT $..... = ... years

EXTRA NET SAVING $.....

This is how fast AIR CONDITIONING WILL PAY FOR ITSELF through increased employee efficiency alone

Because of the fact that employee efficiency can be affected by many factors other than the weather and since savings resulting from air conditioning can therefore be nullified, no figures in this estimating form are to be construed as being guaranteed.

*See table for helpful guide in selecting proper figure.

HOW TO FIGURE PROFIT DUE TO STORE AIR CONDITIONING

Average daily summer sales ..... $.....

*% gross margin ..... X———

Average daily gross profit .....

*No. of working days requiring air conditioning X———

Summer gross profit without air conditioning .....

*% increase from air conditioning ..... X———

EXTRA GROSS PROFIT FROM AIR CONDITIONING .....

Operating cost (estimated)
Electricity and water $.....
Maintenance +———
Total ..... ———

Extra net profit with air conditioning .....

INVESTMENT $..... = ... years

EXTRA NET PROFIT $.....

This is how fast AIR CONDITIONING WILL PAY FOR ITSELF through increased business alone

Because of the fact that total business can be affected by many factors other than the weather and since increases resulting from air conditioning can therefore be nullified, no figures in this estimating form are to be construed as being guaranteed.

*See tables for helpful guides in selecting proper figures.

CITY WEATHER CHART

Average number of working days requiring air conditioning in representative cities

City	No. of Days	City	No. of Days
Atlanta	109	Louisville	95
Baltimore	98	Memphis	98
Boston	70	Miami	120
Chicago	78	Minneapolis	65
Cincinnati	94	New Orleans	113
Cleveland	77	New York	89
Dallas	110	Norfolk	100
Des Moines	85	Oklahoma City	110
Detroit	75	Philadelphia	93
Houston	113	Pittsburgh	78
Kansas City	95	St. Louis	96
Los Angeles	73	Washington	101

SALES INCREASE — GROSS MARGIN

Type of Business	Typical Increase In Summer Sales with Air Conditioning	Average Gross Margin
Department Stores	30%	31.4%
Drug Stores	20	32.8
Grocery Stores	15	17.2
Jewelry Stores	20	39.9
Liquor Stores	15	20.0
Meat Markets	15	17.7
Men's Clothing Stores	30	34.8
Restaurants	40	43.3
Shoe Stores	20	32.9
Taverns and Bars	40	55.9
Variety Stores	20	33.2
Women's Specialty Shops	30	32.4

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

Moisture Movement in Soils Due to Temperature Difference

By W. A. Hadley* and Raymond Eisenstadt**
New York, N. Y.

This paper is the result of research sponsored by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in cooperation with Columbia University, New York, N. Y.

FOR THE PAST three years a series of experiments have been carried on at Columbia University to determine how and why moisture moves in granular media such as soils under a temperature difference. This problem became of interest during a study of heat pumps that used evaporators buried in the ground. These so-called *ground coils* performed in a manner that could not be explained by existing theory. For one thing, the coils seemed to be able to absorb more heat than expected from calculation by accepted heat transfer theory. In fact, the heat absorbed under certain conditions might be 50 percent greater than predicted. Therefore, it seemed that either the theory or the experimental figures on the heat pumps were wrong, or something was happening that had not yet been taken into account.

SUMMARY—Heat pump coils buried in soil under certain conditions absorb up to 50 percent more heat than would be anticipated from thermal transfer calculations. Moisture movement in the soil may be the important factor in causing the difference. This study concerns the form in which the moisture is transferred.

By using a simulated soil, made of glass beads 0.01 in. diameter, adding a small amount of radioactive cobaltous nitrate to the water in the soil, and using a Geiger counter, it was possible to determine whether the moisture transfer under the influence of temperature was in liquid or vapor form.

The test results indicate that a critical moisture content of about 4 percent separates liquid from vapor movement in the soil.

It was also observed that the ground coils seemed to attract water. When one of them was dug up after a winter of operation the soil around it looked like glass and had to be chipped off. When this soil thawed there was so much water in it that the sample showed saturated mud with a layer of clear water standing above it. In other installations the ground heaved up over the ground coils enough to warp and throw out of plumb the buildings being heated. It was thought that the movement of water to the ground coil and the excess heat reaching it were probably

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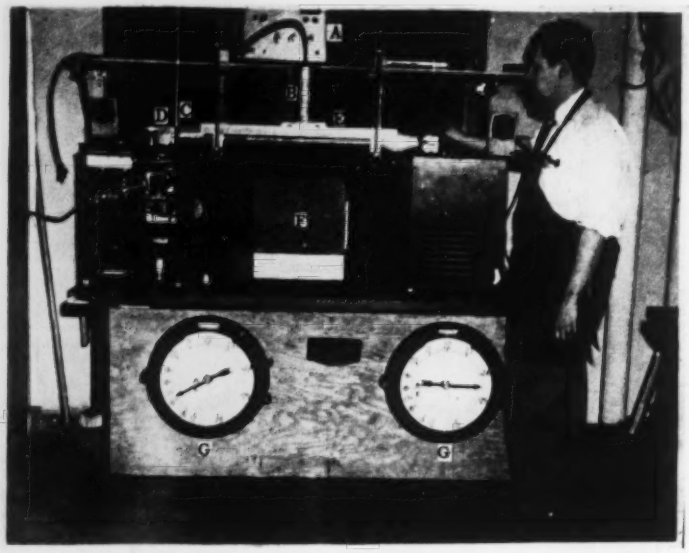

Fig. 1—Arrangement of test apparatus

A. Geiger counter
B. Lead shielded Geiger tube
C. Specimen tube and insulation
D. Brass blocks in oil bath
E. Steel rails and scale
F. Thermocouple cold junction box
G. Temperature controller

factors of the same problem. A search of the literature revealed that W. O. Smith[1] and G. J. Bouyoucos[2] had shown that a temperature difference in a soil caused water to move toward the lower temperature but how it moved, why it moved, and how much water moved was still in doubt. It was decided to try to find answers to some or all of these problems in the proposed studies at Columbia.

One difficulty in conducting research with soils is that soils are not uniform and have particles of such irregular shapes and sizes that calculations of results are difficult. To avoid this difficulty small perfectly spherical glass beads of 0.01 in. diameter resembling white beach sand were used. The particles, being spherical, regular in size, and uniform in other physical properties, permitted calculations to be made and results to be reproduced.

Since all tests were made in this idealized soil medium all references to the performance of actual soils might be in error. It is believed that sands might show a behavior very similar to that obtained with the glass beads while clays might show considerable differences. All references to soils in this report therefore apply to the material tested, since natural soils were not tested and compared with the ideal soil.

In order to determine how the water moved, a radioactive tracer technique was developed. A very small quantity or radioactive cobalt 60 (the material now being used to treat cancer) in the form of cobaltous nitrate added to water (0.1 gm per liter) would have no appreciable effect on the properties of the water but could be detected by a Geiger counter located outside of the thermally insulated specimen pipe containing the soil. This technique had two main advantages:

1. It could be determined whether there was a uniform moisture distribution in the soil specimen at the beginning of a test without taking samples, and weighing, drying, and reweighing. Drying and weighing destroys the soil specimen for test purposes. With the method used in these tests it is only necessary to pass the Geiger tube over the radioactive soil model to determine the initial moisture distribution. The specimen can then still be used for further tests.

2. The form in which the moisture moves can be determined. If all the moisture moves in the liquid form, the moisture

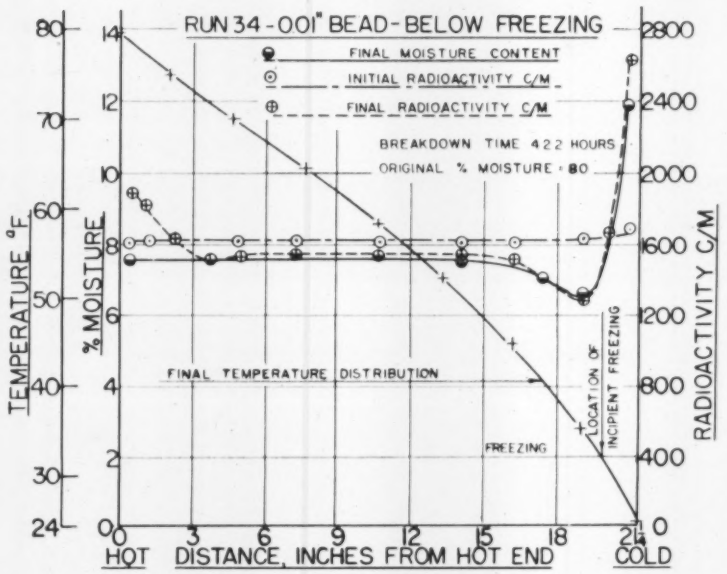

Fig. 2—Temperature, moisture, and radioactivity *vs.* distance in wet soil

[1]Exponent numerals refer to References.

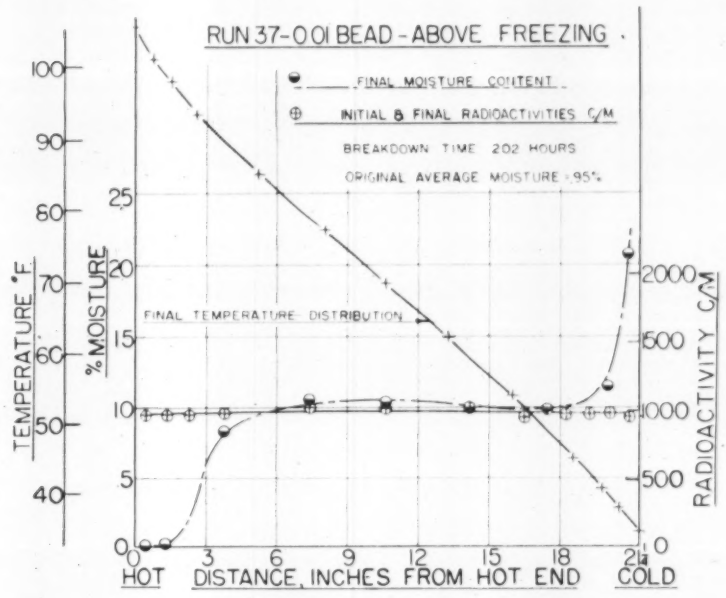

Fig. 3—Temperature, moisture, and radioactivity *vs.* distance in dry soil

content at the end of the test and the radioactivity will be proportional, because the radioactive salt will be carried by the liquid. If all the moisture moves in the vapor phase, the salt will be left behind by the vapor and there will be no change in radioactivity during a test, but, at the end of the test, weighing and drying samples will show that there has been a moisture movement. If part of the moisture moves as a liquid and part as a vapor, a condition will be found half way between the above. Incidentally, by this method, liquid movements can be observed at all times during a test.

The test apparatus is shown in Fig. 1. The boxes shown at either end of the table in Fig. 1 each contain heating coils and refrigeration equipment so that a temperature drop can be produced and maintained along a plastic pipe that connects them. This 1½-in. internal diameter, ⅛-in. thick plastic pipe is well insulated on the outside and is filled with the previously described glass beads used as the soil specimen. Thermocouples are inserted along the length of the pipe to measure the temperature of the soil, and provision is made in the pipe so that samples may be taken rapidly at the end of the run to determine the final moisture content by weighing and drying. The Geiger tube and counter are at the top center of the picture, Fig. 1.

Space does not permit inclusion of all of the results attained during the three year study. However, it is felt that some of the conclusions reached should be of considerable interest.

The most important conclusion reached was that there is a critical moisture content, hitherto unknown, that separates two distinct methods of moisture movement.

In the soils tested this moisture content was about 4 percent moisture by weight of the total dry weight. The moisture movement in soils wetter than this was totally different than the moisture movement in dryer soils. In general, most soils are wetter than the critical, but dryer soils are found.

Fig. 2 is a good example of these so-called wet soils while Fig. 3 is an example of the behavior of the dry soils (the abbreviation C/M is counts per minute). If Fig. 2 is studied, certain conditions become apparent in light of the previous discussion.

1. The moisture movement at the cold end is apparently all in the liquid phase because the curve of radioactivity coincides with the curve of final moisture content. (There is some vapor movement at the hot end, a separate phenomenon that

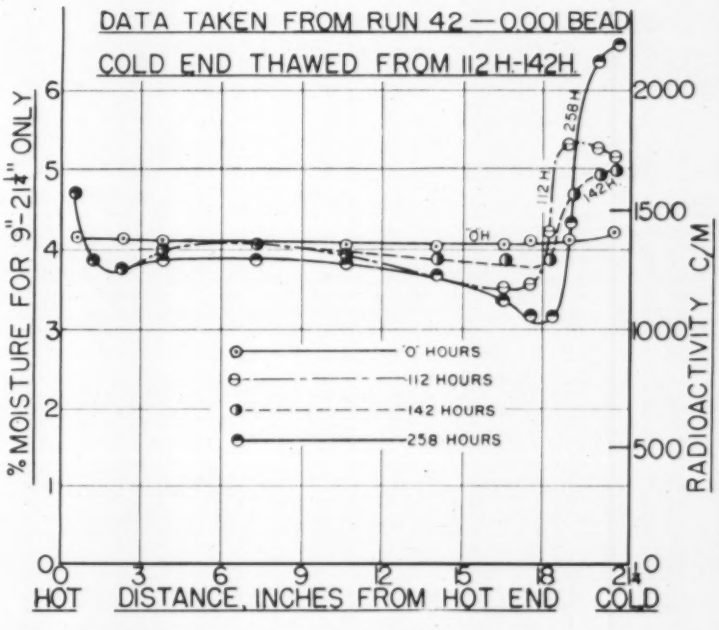

Fig. 4—Radioactivity *vs.* distance, freezing — thawing run

is being studied in greater detail as it is of considerable interest in underground electrical cable work.)

2. The increase in moisture content coincides roughly with the ice point, or 32 F temperature, in the pipe. In other runs where temperatures were maintained above 32 F no moisture movement in the wet samples was observed.

3. It will be noted that the moisture content of the whole curve is uniformly depressed except in the region adjacent to the freezing where a sharp depression occurs. It appears that the moisture build-up at the cold end is obtained initially from the adjacent unfrozen zone which in turn is replenished from the rest of the pipe.

In contrast to conditions in Fig. 2, Fig. 3 illustrates the effect of dry soil (*i.e.* soil having less than critical moisture content). It will be noted that: (1) all of the moisture movement is apparently in the vapor phase, because there is no change in radioactivity from the beginning to the end of the run while there is a change in moisture content; and (2) this is not a phenomenon associated with freezing. It should be noted that the conditions described above, although previously suspected in part, were up until now unverified and in some cases unexplored.

These two phenomena and the apparent critical moisture content condition that separates them are being studied further with the expectation that the mechanism involved will be the subject of another paper in the near future.

The information uncovered by this investigation is of threefold interest to heating and ventilating engineers. This work bears a direct relationship to *heat pump ground coils*, to *air conditioning in mines*, and to an understanding of that *Arctic soil condition* called *permafrost*. How much direct quantitative help can be derived is still in question, because it should be remembered that these initial laboratory tests by necessity are oversimplified as compared with conditions obtained in undisturbed natural soils. However, additional studies can be made that will provide information that can be used directly in calculations. Bearing this in mind, the following significant facts may be noted:

With respect to heat pump ground coils, it is possible (and even probable) that a considerable amount of heat is carried directly to the ground coil by the water movement. In the laboratory apparatus it was calculated that the heat transferred by conventional heat transfer amounted to 10 Btu per (sq ft) (hr) in the wet soils while the water migrated in the wet soils at an average rate as high as 15 grams per (sq ft) (hr) yielding a latent heat of fusion of the order of 5 Btu per (sq ft) (hr).

If this condition also exists in the earth, the discrepancy between theory and practice is accounted for. Conventionally, heat pumps are operated in an off-on cycling fashion. Fig. 4 shows the effect of starting and stopping. It should be noted that this method of operation seems to accentuate the phenomena and that in the *off* period a considerable amount of moisture appears to melt and is left in a position easily available for another moisture migration, thus increasing the amount of moisture adjacent to the cold face. In fact, at 112 hr (in Fig. 4) the rate of increase of the moisture at the cold end was very slow, indicating that an equilibrium point was not far away. At that time the cold end temperature was allowed to rise to room temperature and the resulting curve is shown at 112 hr. At 142 hr the temperature at the cold end was again reduced. This caused the curve to rise far above the level the original curve had been approaching. Therefore, *on-off* operation should give considerably more heat than is calculated on the basis of the amount of moisture found frozen around the ground coil at the end of a heating season.

In dry soils (which in this idealized case means soils below about 4 percent moisture) the total amount of heat transferred by the moisture is considerably less, even though the vapor furnishes both its latent heat of evaporation and its latent heat of fusion. The moisture movement in this case can account for about 0.3 Btu per (sq ft) (hr) or about 16 percent of the amount transferred in wet soils. However, the total amount of heat transferred in dry soils is also a smaller portion of that in wet soils due to the smaller thermal conductivity of dry soil. Hence, the percent of the total heat that might be chargeable to moisture movement may still be high. However, the total heat transferred in any case is so small that the installation of heat pump ground coils in soils below the critical moisture content is therefore doubly undesirable. Determination of the value of the critical moisture content for various types of real soils would be a valuable project.

An air conditioned mine shaft resembles a heat pump ground coil in that it is a cold conduit in the earth. There has been some speculation as to the amount of moisture that might migrate into mine shafts due to the temperature gradient. On the basis of the present study this consideration can be largely eliminated because no appreciable moisture movement was found in the wet soils without freezing temperatures and the soils will rarely, if ever, be below the critical moisture content.

Permafrost is the term applied to the portion of the ground in the Arctic that stays frozen all year round. It creates a difficulty when a heated building is constructed in the Arctic as the heat from the building melts the permafrost on which the building foundation rests. This study gives some insight into the nature of permafrost. The frozen portion of the soil in Fig. 2 and the part remaining frozen in Fig. 4 are analogous to permafrost. This would indicate that high moisture contents might characterize permafrost in soils above the critical while, if soils could be maintained below the critical no problem might exist. These statements are at best exploratory on the basis of the present work. However, additional work in this field on permafrost might be not only pertinent but highly productive.

References

1. Thermal Transfer of Moisture in Soils, by W. O. Smith. *Transactions of the American Geophysical Union*, 1943.

2. G. J. Bouyoucos, *Michigan Agricultural Experiment Station, Tech. Bull.* 22, 1915, pp. 1-63.

Performance of a Forced-Draft Cooling Tower

By B. H. Spurlock, Jr.,* Boulder, Colo.

SUMMARY — This paper represents an initial report on a project currently being undertaken by the graduate students in the Department of Mechanical Engineering at the University of Colorado. It is the purpose of this project to make a study of the cooling tower in order to arrive at a rational basis of design.

The paper considers the fundamental assumptions and equations involved and gives the performance of a forced-draft cooling tower measured in terms of the dimensionless quantity

$$K_m = \frac{f_m a_m V}{L}$$

Specifically the performance of the tower is determined to discover the effect of spacing of slat-type packing and the effect of varying the angle of packing on the quantity K_m.

THE PERFORMANCE of a cooling tower and especially a forced-draft tower is of interest to many in the field of air conditioning.

Merkel[1] laid the foundations, in 1925 for an analytical analysis of the thermodynamic process involved in the transfer of mass in the tower. Nottage,[2] Mickley,[3] Lichtenstein[4] and others have added to this analysis and have shown that the performance of the tower can be related by the dimensionless quantity

$$\frac{f_m a_m V}{L}$$

The theoretical content of this report has been drawn from the Bibliography. Particular reference is made to the work of Mickley[3] and Lichtenstein,[4] who have made a rather complete analysis of the cooling tower. The reader is recommended to extend his background by use of these and other references.

The experimental research included here covers the effect of spacing of the slat-type packing and the angle of the slats upon the above dimensionless quantity.

Assumptions

The following assumptions are considered as a basis of derivation of the equations involved in the cooling tower performance: (1) Tower is forced-draft, adiabatic, counterflow, and constant cross-section; (2) Enthalpy of gas-vapor mixture may be represented by Equation 1; (3) Evaporation of water is negligible; (4) Variation in humid heat may be neglected; (5) Interaction of simultaneous heat and mass transfer in film may be neglected; (6) Lewis relation is valid and $f_c = C_{ps} f_m$; (7) Area of heat transfer is equal to the area for mass transfer, *i.e.* $a_c = a_m$; (8) Enthalpy of liquid is negligible compared to that of vapor.

Basic Equations

It is assumed that the enthalpy of the air-vapor mixture can be represented by the expression

$$h_g = C_{ps}(t_g - t_o) + \lambda_o H_g \qquad (1)$$

where

$C_{ps} = 0.24 + 0.45\,H_s$ = Specific heat of humid air.

An enthalpy or heat balance on a differential volume of the tower is given by

$$G\,d[h_g] = d[L\,C_{p_L}(t_L - t_o)]$$

which reduces to

$$G\,dh_g = L\,C_{p_L}\,dt_L \qquad (2)$$

provided the evaporation (small) is omitted. Then

$$\frac{dh_g}{dt_L} = \frac{L\,C_{p_L}}{G} \qquad (3)$$

The rate of heat transfer can be based on (*a*) (*b*) or (*c*):

(*a*). Heat transfer through the liquid film

$$dq = f_{cL}\,a_c\,(t_L - t_i)\,dV \qquad (4)$$

(*b*). Heat transfer through the air film

$$dq = f_{cg}\,a_c\,(t_i - t_g)\,dV \qquad (5)$$

(*c*). Heat transfer based on the overall coefficient

$$dq = f_c\,a_c\,(t_L - t_g)\,dV \qquad (6)$$

Similar equations for mass transfer may be based on (*a*) (*b*) or (*c*):

(*a*). Liquid film transfer

$$G\,dH_g = f_{mL}\,a_m\,(H_L - H_i)\,dV \qquad (7)$$

(*b*). Gaseous film transfer

$$G\,dH_g = f_{mg}\,a_m\,(H_i - H_g)\,dV \qquad (8)$$

(*c*). Overall transfer coefficient

$$G\,dH_g = f_m\,a_m\,(H_L - H_g)\,dV \qquad (9)$$

Equation 3 may be integrated directly to give

$$h_{g_2} - h_{g_1} = \frac{L\,C_{p_L}(t_{L_2} - t_{L_1})}{G} \qquad (10)$$

which is termed the *operating line*. The heat transfer across the gaseous film.

$$dq = f_{cg}\,a_c\,(t_i - t_g)\,dV$$

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[1]Exponent numerals refer to Bibliography.

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is equal to the rise in enthalpy of the mixture $G dh_g$, *or*

$$G\,dh_g = f_{cg} a_c (t_i - t_g)\,dV \quad \ldots\ldots\ldots (11)$$

Assuming the validity of the Lewis relation

$$\frac{f_{cg}}{f_{mg}} = C_{ps} \quad \ldots\ldots\ldots (12)$$

Equation 11 becomes

$$G\,dh_g = f_{mg} C_{ps}\, a_c (t_i - t_g)\,dV \quad \ldots\ldots (13)$$

or if $a_m = a_c$ then

$$G\,dh_g = f_{mg} a_m (h_i - h_g)\,dV \quad \ldots\ldots (14)$$

and

$$\frac{G\,dh_g}{(h_i - h_g)} = f_{mg} a_m\,dV \quad \ldots\ldots (15)$$

If it had been assumed that the Lewis relation is given by

$$\frac{f_c}{f_m} = C_{ps}$$

then

$$G\,dh_g = f_m C_{ps}\, a_m (t_L - t_g)\,dV$$

or

$$\frac{dh_g}{(h_L - h_g)} = \frac{f_m a_m\,dV}{G} \quad \ldots\ldots\ldots (16)$$

From Equation 2

$$G\,dh_g = L C_{pL}\,dt_L$$

and Equation 6

$$G\,dh_g = L C_{pL}\,dt_L = f_c a_c (t_L - t_g)\,dV$$

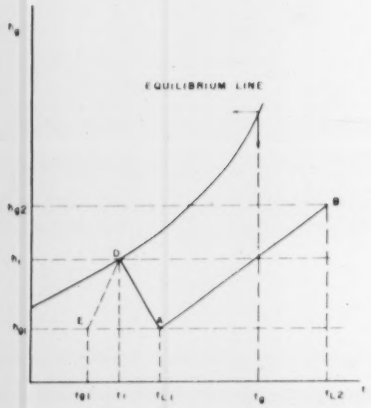

Fig. 1—Temperature-enthalpy diagram for cooling tower process

Nomenclature

a_c = interfacial area for heat transfer, square feet per cubic foot of tower volume.
a_m = interfacial area for mass transfer, square feet per cubic foot of tower volume.
C_{pL} = specific heat of water, Btu per (pound) (Fahrenheit degree).
C_{ps} = specific heat of humid air, Btu per (pound) (Fahrenheit degree).
f_c = overall thermal conductance, Btu per (square foot) (hour) (Fahrenheit degree).
$f_{c,g}$ = thermal conductance of gaseous film, Btu per (square foot) (hour) (Fahrenheit degree).
$f_{c,L}$ = thermal conductance of liquid film, Btu per (square foot) (hour) (Fahrenheit degree).
f_m = overall mass conductance, pounds per (hour) (square foot).
f_{mg} = mass conductance of gaseous film, pounds per (hour) (square foot).
f_{mL} = mass conductance of liquid film, pounds per (hour) (square foot).
G = rate of air flow, pounds per (hour) (square foot tower area).
H_g = specific humidity of humid air, pounds water per pound dry air.
H_i = specific humidity of air at interface temperature t_i, pounds water per pound dry air.
H_L = specific humidity of air at liquid temperature t_L, pounds water per pound dry air.
h_g = enthalpy of humid air at t_g, Btu per pound dry air.
h_i = enthalpy of humid air at t_i, Btu per pound dry air.
h_L = enthalpy of humid air at t_L, Btu per pound dry air.
K_m = overall performance factor ($f_m a_m V/L$).
L = rate of water flow, pounds per (hour) (square foot of tower area).
q = rate of heat transfer, Btu per hour.
t = temperature (Fahrenheit).
t_g = temperature of air stream, (Fahrenheit).
t_i = temperature of humid air at interface, (Fahrenheit).
t_L = temperature of water, (Fahrenheit).
t_o = base temperature of enthalpy, (Fahrenheit).
V = volume of tower, cubic feet.
λ_o = latent heat of vaporization, Btu per pound.

and noting that

$$\frac{f_c}{f_m} = C_{ps} \quad \text{and} \quad C_{pL} = 1$$

$$L \times 1 \times dt_L = f_m C_{ps}\, a_m (t_L - t_g)\,dV$$

or

$$\frac{dt_L}{(t_L - h_g)} = f_m a_m\,dV \quad \ldots\ldots\ldots (17)$$

From Equation 4

$$G\,dh_g = f_{cL} a_c (t_L - t_i)\,dV$$

and Equation 14

$$G\,dh_g = f_m a_m (h_i - h_g)\,dV$$

it follows that

$$\frac{(h_i - h_g)}{(t_L - t_i)} = \frac{f_{cL}}{f_m} \quad \ldots\ldots\ldots (18)$$

This expression is termed the *tie line* by Mickley.

Also dividing Equation 14 by Equation 11

$$\frac{dh_g}{dt_g} = \frac{(h_i - h_g)}{(t_i - t_g)} \quad \ldots\ldots\ldots (19)$$

Considering Equation 15, the right side is readily integrated and

$$\int_{h_{g_1}}^{h_{g_2}} \frac{dh_g}{(h_i - h_g)} = \frac{f_{mg} a_m V}{G} \quad \ldots\ldots (20)$$

It is apparent from Equation 20 that the left side is dependent on the thermodynamic properties of the media throughout the tower, while the right side of the equation is a function of the tower design. The performance of the tower is consequently a function of the dimensionless term

$$(f_{mg} a_m V)/G$$

Due to the difficulty of expressing the enthalpy of the gas-vapor mix-

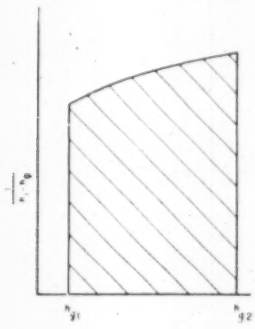

Fig. 2—Graphical representation of the integral

$$\int \frac{dh_g}{(h_i - h_g)}$$

ture h_i at the interface, in terms of the enthalpy h_g, it is necessary to employ graphical integration to the left side of Equation 20. Such an integration may be performed by a chart such as shown in Fig. 1, plotting the enthalpy of the gas-vapor mixture h_g as a function of the temperature. The horizontal ordinate may be used to represent the gas stream or the liquid temperature throughout the tower. The curved line, marked *equilibrium line* on the chart, represents the equilibrium conditions for saturated air at the interface temperature and may be calculated directly from tables or taken from the psychrometric chart. The line AB is plotted directly from Equation 10 and represents the end points at the base A and top B of the tower. The slope of the *operating line* AB represents the liquid to gas ratio L/G. Point E represents the condition of the gas entering the tower at the temperature t_{g1} and enthalpy h_{g1}. The point D is located by the slope of the line AD determined by Equation 18. The vertical line from D to the horizontal line AE is the factor $(h_i - h_{g1})$ at the base of the tower, and this quantity evaluated throughout the tower height may be plotted reciprocally on a graph such as shown in Fig. 2. The shaded area gives the value of the integral of the left side of Equation 20.

There are several difficulties encountered in using a graph such as described. For example, the equilibrium line is for values at the interface temperatures and the unit conductances f_{eg} and f_{mg} are the gas side of the interface, and these values are not readily determined. In order to evaluate these terms correctly, it would be necessary to determine the conditions throughout the tower, a time consuming operation at best. Lichtenstein[4] suggests a slightly modified presentation of the tower characteristic. This is obtained by assuming that the *equilibrium line* values are those measured at the temperature t_L rather than the interface temperature t_i. Values of the mass and heat transfer coefficients are the overall values f_m and f_e respectively. Then this gives the expression from Equation 17,

$$\int \frac{dt_L}{(h_L - h_g)} = \frac{f_m a_m V}{L} = K_m$$

A graph similar to Fig. 1 can then be plotted in which the *saturated* or equilibrium values are at the temperature of the liquid t_L and not at the interface temperature t_i. As shown in Fig. 3, the vertical distance above the operating line to the equilibrium line represents the quantity $(h_L - h_g)$.

On the same chart but with different scale the quantity

$$1/(h_L - h_g)$$

is shown as a function of t_L. The value of the integral is

$$\int_{t_1}^{t_2} \frac{dt_L}{(h_L - h_g)}$$

and is the area under the curve A'B' and above the horizontal axis.

It will be noted in the derivations given that it was assumed that the air was saturated at the interface temperature t_i, while the alternative solution proposed by Lichtenstein[4] assumes that the saturation temperature of the air corresponds to the temperature of the liquid t_L. Mason[5] indicates that the water film resistance is probably less than 10 percent of the total, and that an error of 20 percent in f_e results in an error of less than 4 percent in the energy exchange. This would seem to justify such an assumption.

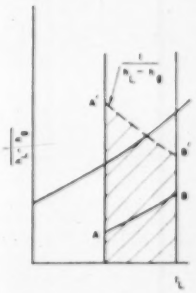

Fig. 3—Temperature-enthalpy diagram for obtaining overall performance factor K_m

Several methods of approach to evaluating this area have been suggested. A common practice is to use the *log mean potential* method, but Lichtenstein[4] points out that the results of this approach are not reliable. Actually little error is involved in assuming a straight line if the range of cooling is not too great, and such a method was adopted in determining the cooling tower performance reported in this paper.

As indicated in the foregoing the quantity $(f_{mg}a_mV)/G$ or $(f_m a_m V)/L$ is a measure of the performance of a cooling tower and is designated K_m. The accompanying curves indicate the effect of packing spacing and slat angle upon the overall performance factor K_m.

Description of Test Apparatus

The tower had a working height of 16 ft and measured 4 ft x 4 ft on the inside. It was constructed of 1-in. cypress and rested in a galvanized sump-tank on a base 1 ft in height (see Fig. 4). Make-up water was provided through a float valve. Water was taken from the sump by a centrifugal pump and circulated through a closed heat exchanger, through a control valve to the top of the tower, where it was metered by means of an orifice to a header, and then sprayed into the

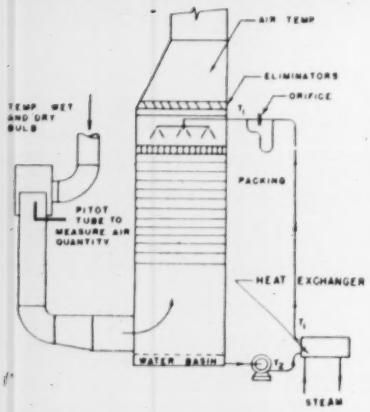

Fig. 4—Diagram of model cooling tower and test arrangement

air stream at the top of the tower by means of four conical nozzles.

The tower itself consisted of three sections. The bottom section, resting in the sump-tank, was 6 ft in height with air entering horizontally through one of the sides, where it was turned upward by experimentally located guide vanes. The middle section was 7 ft high, one side of which was a door for entry and on the adjacent side were located brackets to support the packing. The top section of the tower housed the drift eliminators, spray nozzles, and an *egg crate* straightener, located in that order from the top down. The straightener was provided to promote uniform distribution and minimize the water flowing down the side walls.

Air was circulated through the system, by means of a centrifugal fan, and was drawn in from the roof of the laboratory, was conveyed through a 2-ft diameter duct and was introduced horizontally into the tower at the base. The air left the top of the tower and was exhausted to the outside of the laboratory at some distance east of the entrance section.

The packing consisted of a number of trays or rows that were arranged on brackets provided within the center section of the tower. Each tray contained 38 redwood slats, $2\frac{3}{4}$ x $\frac{3}{8}$ in. and slightly less than 4 ft in length. The angle of the slat could be adjusted as desired. The position of each tray was rotated 90 deg about a vertical axis with respect to the tray below.

The essential metering and measuring devices were located as shown in Fig. 4. All temperatures in the tower were measured by proper location of copper-constantan thermocouples. For measuring wet-bulb temperatures, thermocouple junctions were buried in wetted wicks. Wet-bulb and dry-bulb thermometers in the inlet and leaving air were used to check wet- and dry-bulb temperatures. Three wet-bulb and two dry-bulb readings were averaged to obtain the inlet air conditions. Two thermocouple junctions in plastic cones, to keep them dry, and two junctions in wetted wicking located above the eliminators measured the outlet air dry-bulb and wet-bulb temperatures, respectively. A thermocouple sealed in a brass plug and extended into the water stream in the 2-in. pipe near the header section at the top of the tower measured the inlet water temperature. Two thermocouples immersed in the sump-tank at opposite sides of the tower base measured the temperature of the water leaving the tower.

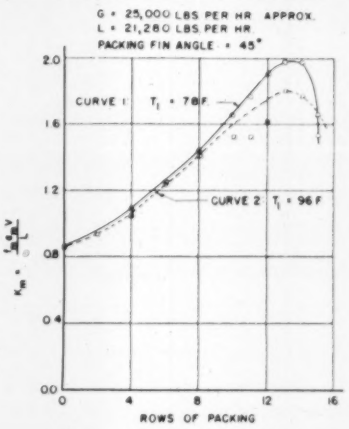

Fig. 5—Overall performance factor K_m *vs* rows of packing (Plot of the results in Tables 1 and 2)

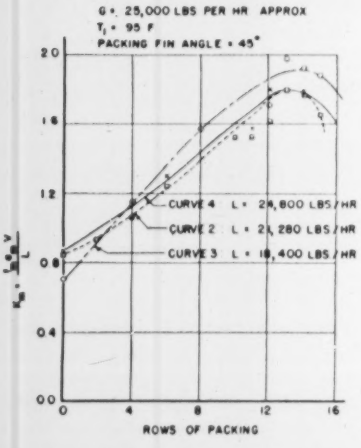
G = 25,000 LBS PER HR APPROX
T1 = 95 F
PACKING FIN ANGLE = 45°
CURVE 4 L = 24,800 LBS/HR
CURVE 2 L = 21,280 LBS/HR
CURVE 3 L = 18,400 LBS/HR
ROWS OF PACKING

Fig. 6—Overall performance factor K_m *vs* rows of packing (Plot of the results in Tables 2, 3, and 4)

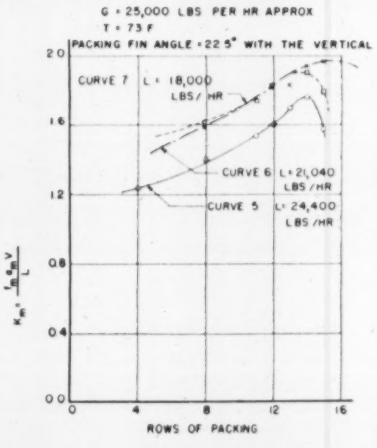
G = 25,000 LBS PER HR APPROX
T = 73 F
PACKING FIN ANGLE = 22.5° WITH THE VERTICAL
CURVE 7 L = 18,000 LBS/HR
CURVE 6 L = 21,040 LBS/HR
CURVE 5 L = 24,400 LBS/HR
ROWS OF PACKING

Fig. 7—Overall performance factor K_m *vs* rows of packing (Plot of the results in Tables 5, 6, and 7)

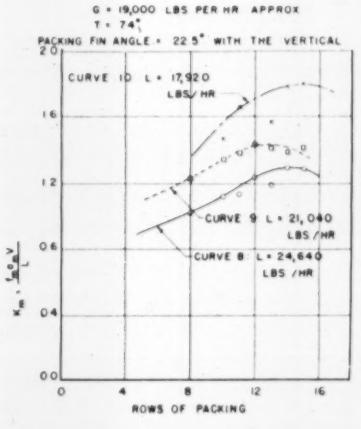
G = 19,000 LBS PER HR APPROX
T = 74°
PACKING FIN ANGLE = 22.5° WITH THE VERTICAL
CURVE 10 L = 17,920 LBS/HR
CURVE 9 L = 21,040 LBS/HR
CURVE 8 L = 24,640 LBS/HR
ROWS OF PACKING

Fig. 8—Overall performance factor K_m *vs* rows of packing (Plot of the results in Tables 8, 9, and 10)

Table 1 — Test Data 45 Deg Slats

Packing fins inclined at 45 degrees with the vertical. Water rate, L = 21,280 lb/hr
Inlet water temperature, T_1 = 78 F Air rate, G = 25,000 lb/hr (approx)

Rows of Packing	Water temp. (T_1)	Water temp. (T_2)	Air temp. (t_2)	Air temp. (t_{wet})	Air temp. (t_1)	Mass flow rates (L)	Mass flow rates (G)	Heat lost water (Btu/hr)	Heat gained air (Btu/hr)	Unbalance (Btu/hr)	% Unbalance	Evaporation (Lb/hr)	Water to air ratio (L/G)	Performance $K_{mol}a/L$
0	78.4	64.7	65.0	41.5	60.0	21,280	26,250	281,000	298,500	−17,500	− 6.22	412.7	0.810	0.856
4	77.5	61.8	61.8	39.9	60.7	21,280	24,820	344,000	320,000	23,800	6.93	309.0	0.857	1.086
6	78.0	61.5	63.6	42.0	62.6	21,280	23,850	361,000	317,000	43,500	12.30	306.0	0.892	1.246
8	78.4	60.0	52.0	41.9	63.0	21,280	23,360	399,000	326,200	72,800	18.24	248.5	0.912	1.445
10	78.0	60.0	55.8	42.3	66.4	21,280	23,150	391,000	377,500	13,500	3.45	289.0	0.918	1.657
11	78.4	59.5	54.5	43.0	67.2	21,280	23,150	411,000	412,000	− 1,000	− 0.24	302.0	0.918	1.775
12	78.4	59.3	53.6	42.5	67.6	21,280	23,150	416,000	391,000	25,000	6.01	305.8	0.918	1.910
13	78.4	58.8	55.4	41.5	68.5	21,280	22,250	416,000	406,000	10,000	2.40	328.0	0.955	1.980
14	78.4	59.5	54.0	41.1	68.4	21,280	21,900	412,000	410,000	2,000	4.86	317.5	0.972	1.980
15	77.5	59.0	50.6	36.6	65.4	21,280	21,360	402,000	395,000	7,000	1.74	297.5	0.997	1.536

Table 2 — Test Data 45 Deg Slats

Packing fins inclined at 45 degrees with the vertical. Water rate, L = 21,280 lb/hr
Inlet water temperature, T_1 = 96 F Air rate, G = 25,000 lb/hr (approx)

0	97.6	72.5	52.8	39.0	69.2	21,280	27,150	552,000	559,000	− 7,000	− 1.27	428.0	0.784	0.851
2	96.0	70.8	52.0	38.8	70.2	21,280	25,250	553,000	544,000	9,000	1.63	415.0	0.842	0.937
4	96.4	70.4	58.0	40.4	74.2	21,280	24,650	574,000	609,000	−35,000	− 6.09	389.0	0.863	1.060
6	95.0	67.6	57.2	39.5	74.5	21,280	23,250	601,000	593,000	8,000	1.33	475.0	0.914	1.246
8	96.0	65.0	54.0	38.0	74.1	21,280	23,200	675,500	594,000	81,500	12.08	460.5	0.917	1.415
10	97.6	66.6	50.0	37.5	70.8	21,280	22,570	680,000	734,000	−54,000	− 7.94	545.0	0.943	1.526
11	96.5	65.3	51.5	37.8	78.0	21,280	22,500	672,000	679,000	− 7,000	− 1.42	511.0	0.945	1.528
12	96.6	64.0	51.0	38.5	77.3	21,280	22,480	712,000	661,000	51,000	7.17	496.0	0.946	1.624
13	96.4	63.8	51.0	40.5	79.5	21,280	22,450	712,000	676,000	36,000	5.06	500.0	0.948	1.812
14	96.0	63.4	51.0	40.2	78.4	21,280	22,000	709,000	650,000	59,000	8.42	464.0	0.967	1.782
15	96.0	63.8	52.6	38.5	77.7	21,280	21,250	701,000	628,000	73,000	10.42	460.0	1.001	1.660

Table 3 — Test Data 45 Deg Slats

Packing fins inclined at 45 degrees with the vertical. Water rate, L = 18,400 lb/hr
Inlet water temperature, T_1 = 95 F Air rate, G = 25,000 lb/hr (approx)

0	94.0	71.2	37.5	33.4	59.2	18,400	26,250	430,000	391,500	38,500	8.85	257.0	0.701	0.702
4	95.0	66.0	46.0	38.2	66.8	18,400	26,200	545,000	493,000	52,000	9.54	341.0	0.702	1.152
8	95.0	61.0	41.6	35.4	70.4	18,400	24,750	635,000	582,000	53,000	8.35	354.0	0.743	1.566
12	94.0	60.4	48.5	36.8	72.4	18,400	24,100	632,000	597,500	34,500	5.38	434.0	0.763	1.725
13	95.0	59.8	47.7	38.8	75.4	18,400	23,620	660,000	633,000	27,000	4.10	452.0	0.778	1.986
14	96.0	61.5	52.7	41.3	76.8	18,400	23,120	649,000	626,000	23,000	3.54	469.0	0.796	1.925
15	94.0	61.0	54.5	40.2	75.2	18,400	22,500	621,000	585,000	36,000	5.79	444.0	0.817	1.895

Table 4 — Test Data 45 Deg Slats

Packing fins inclined at 45 degrees with the vertical. Water rate, L = 24,800 lb/hr
Inlet water temperature, T_1 = 95 F Air rate, G = 25,000 lb/hr (approx)

0	95.0	71.4	45.5	36.5	68.0	24,800	26,850	604,000	557,000	47,000	7.78	388.0	0.923	0.868
4	95.0	68.2	46.2	38.1	72.5	24,800	25,350	679,000	614,000	65,000	9.57	388.0	0.978	1.132
8	95.0	67.8	44.8	39.2	78.4	24,960	24,450	696,000	721,000	−25,000	− 3.59	504.0	1.020	1.364
11	95.0	65.0	44.5	38.4	78.0	24,960	23,680	764,000	708,000	56,000	7.32	496.0	1.055	1.575
12	94.0	60.7	34.3	31.2	77.0	24,800	23,800	840,000	766,000	74,000	8.81	496.0	1.042	1.802
13	95.0	61.0	36.2	32.9	76.5	24,800	23,720	807,000	728,000	79,000	9.78	474.0	1.046	1.800
14	95.0	62.4	36.8	32.5	79.6	24,800	23,500	825,000	818,000	7,000	0.85	547.0	1.055	1.802
15	96.0	61.0	38.5	34.9	81.6	24,800	23,200	885,000	835,000	50,000	5.65	567.0	1.068	2.150

Table 5 — Test Data 22.5 Deg Slats

Packing fins inclined at 22.5 degrees with the vertical. Water rate, L = 24,400 lb/hr
Inlet water temperature, T_1 = 76 F Air rate, G = 25,000 lb/hr (approx)

4	77.8	61.3	48.0	39.8	63.8	24,480	25,900	410,000	379,000	31,000	7.56	284.0	0.945	1.240
8	75.6	59.3	50.0	39.9	62.7	24,480	25,600	406,000	371,000	35,000	8.62	274.0	0.957	1.398
11	75.6	58.2	49.7	39.3	63.6	24,400	25,200	432,000	391,000	41,000	9.50	284.0	0.968	1.534
12	74.0	58.8	57.8	43.2	63.8	24,400	24,600	379,000	339,500	39,500	10.40	285.0	0.992	1.596
13	77.0	59.0	52.9	42.3	66.1	24,400	24,850	444,000	400,000	44,000	9.90	286.0	0.982	1.705
14	77.0	59.5	54.7	44.1	67.0	24,320	24,600	433,000	393,500	39,500	9.12	289.0	0.988	1.769
15	78.0	62.4	62.0	45.6	69.4	24,320	24,050	379,000	416,000	−37,000	− 9.76	354.0	1.010	1.566

Table 6 — Test Data 22.5 Deg Slats

Packing fins inclined at 22.5 degrees with the vertical. Water rate, L = 21,040 lb/hr
Inlet water temperature, T_1 = 73 F Air rate, G = 25,000 lb/hr (approx)

8	73.0	58.5	56.5	45.5	62.6	21,040	25,400	310,000	292,000	18,000	5.80	241.0	0.828	1.622
11	73.5	57.8	55.5	44.3	63.4	21,120	25,150	338,000	321,000	17,000	5.02	258.5	0.839	1.748
12	73.0	57.6	56.1	44.8	63.6	21,040	24,950	330,000	317,000	13,000	3.94	257.0	0.844	1.835
13	74.0	58.5	55.2	43.7	63.6	21,040	24,970	333,000	332,000	1,000	0.30	266.0	0.845	1.680
14	72.0	57.0	60.8	44.1	62.7	21,120	24,450	301,000	300,700	300	0.10	274.5	0.865	1.912
15	72.5	58.2	62.0	45.5	64.1	21,040	24,300	308,000	308,500	− 500	− 0.16	281.0	0.867	1.800

Table 7 — Test Data 22.5 Deg Slats

Packing fins inclined at 22.5 degrees with the vertical. Water rate, L = 18,000 lb/hr
Inlet water temperature, T_1 = 73 F Air rate, G = 25,000 lb/hr (approx)

Rows of Packing	Water temp. (T_1)	Water temp. (T_2)	Air temp. (t_2)	Air temp. (t_{wb})	Air temp (t_1)	Mass flow rates (L)	Mass flow rates (G)	Heat lost water (Btu/hr)	Heat gained air (Btu/hr)	Unbalance (Btu/hr)	% Unbalance	Evaporation (Lb/hr)	Water to air ratio (L/G)	Performance $K_m a/m L^{n-1}/L$
8	73.5	56.6	48.0	40.5	60.5	18,000	26,020	310,000	322,500	−12,500	− 4.05	254.5	0.692	1.596
11	72.0	55.0	45.8	40.0	59.8	18,000	25,570	311,000	311,800	− 800	− 0.26	212.0	0.704	1.762
12	72.5	54.5	46.5	40.2	59.5	17,840	25,450	325,000	299,000	26,000	8.00	200.0	0.700	1.848
13	73.5	54.5	45.5	39.0	60.2	17,840	25,350	343,800	329,700	14,100	4.10	228.0	0.704	1.838
14	72.5	53.7	47.1	39.2	59.4	17,920	25,250	341,000	311,000	30,000	8.80	222.0	0.708	1.936
15	73.0	54.0	45.5	39.7	60.2	17,840	25,170	345,500	316,800	27,700	7.77	216.0	0.708	1.968

Table 8 — Test Data 22.5 Deg Slats

Packing fins inclined at 22.5 degrees with the vertical. Water rate, L = 24,640 lb/hr
Inlet water temperature, T_1 = 74 F Air rate, G = 18,000 lb/hr (approx)

8	73.5	60.8	45.0	33.0	63.2	24,640	18,860	320,000	343,200	−23,200	− 7.25	245.0	1.307	1.016
10	74.0	60.3	46.5	33.2	64.0	24,640	18,700	347,000	349,700	− 2,700	− 0.78	256.5	1.320	1.118
11	74.4	61.0	48.0	34.0	65.5	24,640	18,620	341,000	366,500	−25,500	− 7.48	276.0	1.325	1.135
12	74.0	60.2	47.8	34.6	65.6	24,640	18,460	349,000	360,000	−11,000	− 3.15	265.0	1.336	1.240
13	74.5	61.0	50.5	35.0	66.1	24,720	18,260	341,000	359,800	−18,800	− 5.51	274.0	1.354	1.188
14	73.5	60.3	48.8	35.9	66.4	24,640	18,080	334,000	353,800	−19,800	− 5.93	261.0	1.364	1.301
15	74.0	60.7	52.0	37.0	66.7	24,640	17,840	337,000	346,000	− 9,000	− 2.67	265.0	1.383	1.296

Table 9 — Test Data 22.5 Deg Slats

Packing fins inclined at 22.5 degrees with the vertical. Water rate, L = 21,040 lb/hr
Inlet water temperature, T_1 = 74 F Air rate, G = 19,000 lb/hr (approx)

8	73.5	57.6	44.0	31.2	61.1	21,120	20,650	342,000	367,200	−25,200	− 7.37	257.0	1.022	1.235
10	73.5	56.6	42.3	30.4	61.7	21,040	20,230	363,000	376,500	−13,500	− 3.72	257.0	1.040	1.356
11	73.0	55.7	41.8	30.0	60.5	21,040	20,000	370,000	348,000	22,000	5.94	243.0	1.053	1.590
12	74.0	56.0	44.0	30.8	62.6	21,040	19,920	386,000	370,500	15,500	4.01	266.0	1.057	1.488
13	74.0	57.2	42.8	31.5	63.5	20,960	19,880	358,000	378,000	−20,000	− 5.58	266.0	1.052	1.420
14	72.5	56.2	42.8	31.5	61.6	21,040	19,850	348,000	349,500	− 1,500	− 0.43	244.0	1.062	1.400
15	72.5	56.2	42.0	31.8	62.9	20,960	19,680	347,000	364,000	−17,000	− 4.90	248.0	1.063	1.426

Table 10 — Test Data 22.5 Deg Slats

Packing fins inclined at 22.5 degrees with the vertical. Water rate, L = 17,920 lb/hr
Inlet water temperature, T_1 = 73 F Air rate, G = 20,000 lb/hr (approx)

10	72.5	55.8	45.5	35.5	49.9	17,920	20,620	304,000	297,200	6,800	2.24	214.0	0.868	1.478
11	72.5	55.0	45.5	35.4	61.2	17,920	20,620	316,000	319,800	− 3,800	− 1.20	228.0	0.868	1.668
12	72.5	55.0	46.8	36.6	61.1	17,840	20,570	317,000	306,500	10,500	3.31	220.0	0.868	1.716
13	72.5	56.0	48.0	38.0	60.6	17,840	20,400	299,000	281,600	17,400	5.82	207.0	0.874	1.572
14	73.0	56.4	51.0	40.3	62.8	17,840	20,250	302,000	290,000	1,200	0.40	220.0	0.880	1.810
15	73.0	56.4	50.6	40.0	63.8	17,920	20,120	302,000	307,800	− 5,800	− 1.92	230.0	0.890	1.880

The water, controlled by a valve, was metered by a calibrated flat plate square-edged orifice, placed in the line up-stream from the header. The differential pressure was read on a mercury-filled draft gage.

The air flow was determined by a pitot-static tube, located in the center of the duct, after the blower, and connected to a recording draft gage. The average velocity was obtained and plotted as a function of the differential pressure measured at the center line and corrected for density. The average velocity was calculated from a 20-position duct-traverse for each point on the curve.

Results

After a number of preliminary tests a general procedure for all runs was established. A range of inlet conditions similar to those that might occur in actual practice was selected. For each set of inlet conditions, a series of runs was made, each following the addition or removal of rows of packing, or a change in the angle of the slat, noting the leaving air and water conditions. When rows of packing were removed the remaining packing was evenly distributed in the tower. Runs were of approximately 30 min in length, to obtain steady state conditions.

As a means of checking the accuracy of the results a check was obtained by calculating a heat balance. Runs with a discrepancy of more than 10 percent, based on the heat given up by the water, were repeated.

Figs. 5 to 8, inclusive, give the effect of the rows of packing and angle of the slat, upon the performance of the tower measured by the quantity, $K_m a$.

Fig. 5 shows the performance for two constant inlet water temperatures 78 F and 96 F, with a slat angle of 45 deg, and a water rate of 21,280 lb per hr and an air rate of approximately 25,000 lb per hr.

Fig. 6 indicates the performance for three different water rates (18,400, 21,280, 24,800 lb per hr) and an air rate of approximately 25,000 lb per hr with an inlet water temperature of 95 F and a slat angle of 45 deg.

Fig. 7 is similar to Fig. 6, but with an inlet water temperature of 73 F and a slat angle of 22½ deg.

Fig. 8 is approximately the same as Fig. 7, but is for an air rate of approximately 19,000 lb per hr.

Fig. 9 gives the effect of changing

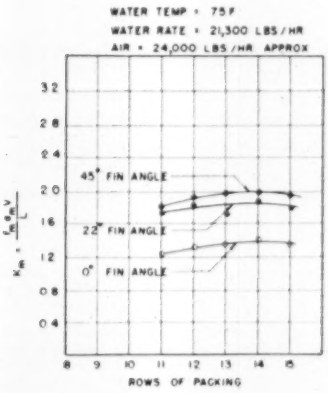

Fig. 9—Overall performance factor K_m *vs* rows of packing

the slat angle and the amount of packing. The conditions maintained were 75 F inlet water temperature, 21,300 lb per hr water flow rate, and approximately 24,000 lb per hr air flow rate.

Fig. 10 plots the maximum values of the overall performance factor K_m as a function of the water to air ratio L/G.

Discussion of Results

It should be pointed out that the air-flow rates represented on the curves of Figs. 5 to 10 are approximate values for the range covered. For example, the air-flow rate noted on Fig. 7, Curve 6 is shown as approximately 25,000 lb per hr, whereas actually it varied from 25,400 lb per hr, with 8 rows of packing to 24,300 lb per hr, with 15 rows of packing. This, of course, will affect the results shown in the curves. If Curve 6, Fig. 7, is compared with Curve 9, Fig. 8, both of which are the same except for rate of air flow, it will be noted that for an air flow rate of 24,450 lb per hr (Table 6) K_m has a value of 1.91 and for an air flow rate of 19,680 lb per hr (Table 9) K_m is 1.40, for 14 rows of packing. This indicates an increase of K_m of about 0.1 for each 1000 lb per hr increase in the air flow rate. Hence the curves for constant rate of air flow beginning at the initial rate would be expected to fall directly above those shown.

The results in Fig. 10 indicate a higher performance than does Lichtenstein's curve, sketched in for comparison. The discrepancy is in the amount of packing, as Lichtenstein's rows of packing were on 15-in. centers and the present ones correspond to about 6-in. centers. If reference is made again in Fig. 8, to six rows of packing (approximately 15-in. centers) the value of K_m is in agreement with Lichtenstein's results. It would appear that the performance in Lichtenstein's work could be increased by introducing more rows of packing. This would be likely to increase the power requirements considerably. A cost analysis would be required to determine the increase.

It is shown in Fig. 9, that an increase of approximately 30 percent is obtained by slats set at an angle of 22½ deg with the vertical when compared with vertical slats. An additional 12 percent can be obtained by increasing the slat angle to 45 deg. It must be remembered, however, that the power consumption will be increased considerably more for the second 22½ deg than for the first increment.

Further Investigations

This investigation should be extended to cover the effects of different kinds of packing. In addition, a study should be made to determine the part that water running down the walls plays in the overall process. It appears that a higher performance is obtained with a minimum of film surface. Its effect on overall performance should be evaluated.

The assumptions made at the beginning of this paper should be validated not alone for the overall performance, but with regard to their individual effects.

After a complete study is made of the model-type tower, a full scale tower should be tested to ascertain the possible correlation with the prototype.

A study of the power involved will also be necessary in order to establish a rational basis of design.

Acknowledgment

The author wishes to acknowledge the test data shown here as being the cooperative results of graduate students in the Department of Mechanical Engineering at the University of Colorado, and in particular to G. T. Spitzmiller[6] and W. D. Sivers[7].

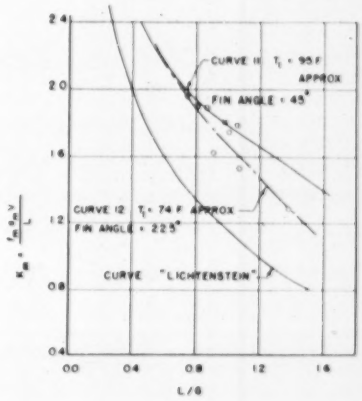

Fig. 10—Plot of the maximum values of K_m as given by each of the curves 1 to 10 *vs* L/G ratio for the point of maximum K_m for each curve

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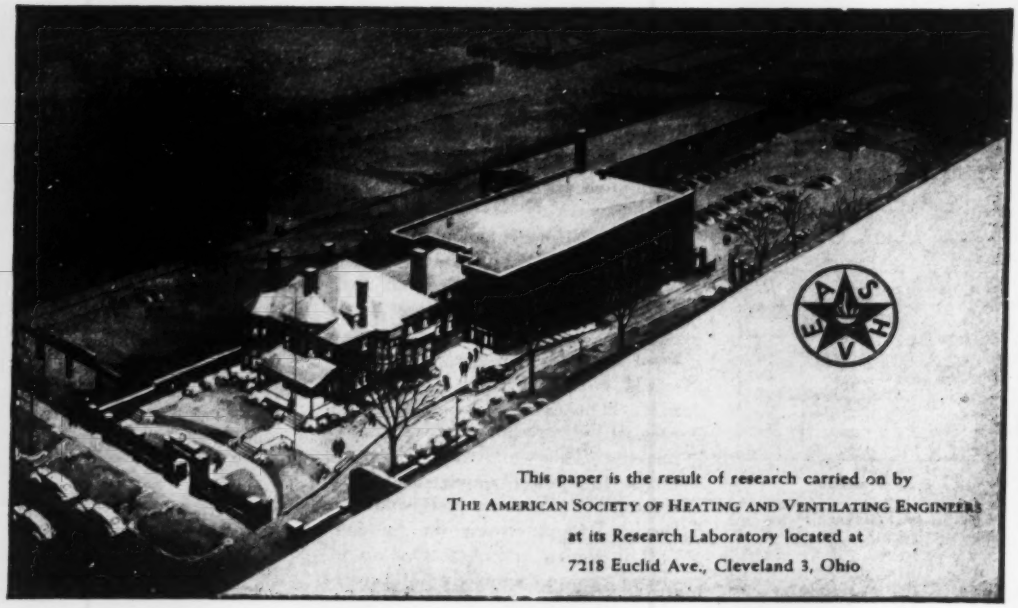
7. The Effect on the Performance of the University of Colorado Research Forced Draft Cooling Tower by Varying the Angle of Packing Fins, by W. D. Sivers (University of Colorado Master's Thesis, 1951, 52 pp.).


This paper is the result of research carried on by
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
at its Research Laboratory located at
7218 Euclid Ave., Cleveland 3, Ohio

Further Studies of the Thermal Characteristics of Plaster Panels

By L. F. Schutrum* and C. M. Humphreys**,
Cleveland, Ohio

SUMMARY—The importance of having good contact between the tubes and the lath and plaster in heating panels is shown by tests of two panels in which the tubes located above metal lath were wired to the lath at 8-in. intervals along each tube. The plaster was applied by an experienced craftsman and the embedment of tubes was judged by observers to be equal to field practice in one panel and superior in the other. Back-plaster was applied over the tubes in the average panel which then showed performance for the 8-in. tube spacing equal to that of 6-in. spacing without back-plastering.

Comparisons are made with tests of four panels previously tested, and examples in determining required tube temperature are included. Effective conductance is given for the six panels.

WHEN THE FIRST results of studies at the ASHVE Research Laboratory on the thermal characteristics of plaster panels were published[1] in July 1951, it was questioned whether the four panels tested were truly representative of plaster panels found in practice, particularly with regard to tube embedment. The chief reason for doubt seemed to be that the heat output of the panels was somewhat at variance with those normally used to design ceiling panel heating systems. The first four panels which had been built to represent three conventional types, included one panel with tubes below gypsum lath, one with tubes below expanded metal lath, and two with tubes above expanded metal lath.

In an attempt to settle the question raised, it was decided to build two additional panels, with tubes placed above metal lath, one of which would have unusually good tube embedment, the other rather poor tube embedment.

This report covers the results obtained with these two panels and compares performance with that obtained with the other four panels. All these studies were made under the advisory guidance of Group A[D] of the Technical Advisory Committee on Panel Heating and Cooling as a part of the Society's overall research program, organized to develop design data for panel heating and cooling systems.

Panel Construction

Two panels were constructed on wood frames 6 ft square, with joists in the test section located on 16-in.

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[1]Exponent numerals refer to References.

For presentation at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Denver, Colo., June 29-30, July 1, 1953.

[D]*Personnel*: R. S. Dill, Chairman; H. L. Flodin, F. E. Giesecke, G. D. Lain, R. L. Maher, V. L. Miller, D. L. Mills, C. W. Nessell, F. E. Parsons, S. I. Rottmayer, R. T. Schoerner, E. E. Scott, S. K. Smith, R. K. Thulman, S. M. Van Kirk, L. H. Yeager.

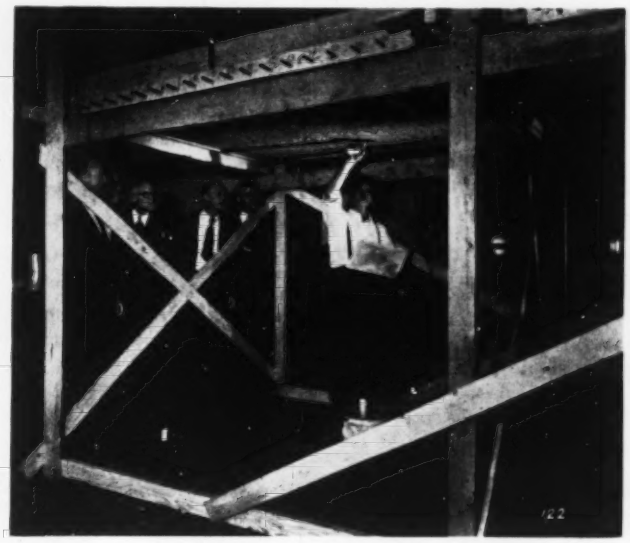

Fig. 1—Application of plaster to test panel

centers. Each panel contained seventeen $\frac{3}{8}$-in. nominal ($\frac{1}{2}$-in. O.D.) nonferrous tubes, located on 4-in. centers above the metal lath. *The lath was wired securely to each tube at 8-in. intervals.* The plaster was applied in three coats: scratch, brown, and finish, to a depth of $\frac{3}{4}$-in. below the lath. The first (scratch) coat, which consisted of one part unfibered neat gypsum and two parts sand, by weight, penetrated the lath and partially embedded the tubes. The second (brown) coat consisted of one part unfibered neat gypsum and three parts of sand, by weight. The finish coat consisted of three parts lime putty and one part gaging plaster, by volume. These plaster mixes conformed to the standard specification for gypsum plastering.[2] Plastering was done by an experienced craftsman with the panel frames supported overhead in a horizontal position (Fig. 1). The plastering operation was observed by a number of Committee members who expressed the view that one panel, (No. 5), had much better embedment than found in practice, and that the other, (No. 6), was nearly as good as that generally found in the field.

Panels Nos. 5 and 6 differed in one important respect from panels of similar construction, Nos. 1 and 3, used in earlier studies.[1] In panels Nos. 5 and 6, the lath and tubes were wired together at 8-in. intervals along each tube; similar ties had been inadvertently omitted from earlier panels. Another variation was in the type of lath used. Panel No. 1 had flat rib metal lath weighing 2.5 lb per sq yd; panels Nos. 3, 5, and 6 had diamond key type metal lath weighing about 3.1 lb per sq yd. It is not believed that the difference between the two types of metal lath was of any significance in effect on the results.

Test Apparatus and Procedure

Test apparatus, instrumentation, and procedures were the same as those used in the previous studies.[1] The panel to be tested was placed between two heat absorbers, as shown in Fig. 2. It was possible to control the heat flow rate from each side of the panel by maintaining the heat absorber temperatures at the proper levels. Heat flow rates were measured by heat flow meters incorporated in the absorber construction. Guards were placed along the four sides of each absorber to eliminate edge losses. As an additional check on the heat flow measurements, two plate-type heat flow meters[3] (each 11-$\frac{1}{2}$ in. sq) were installed in each of the two absorbers. The metering accuracy of the two absorbers, determined by electrical calibration, was found to be within 5 percent of the measured input.

The tubes or pipes embedded in each panel were connected to headers to form a grid-type coil. By selective valving of key cocks provided on each tube, tests were made with 4, 8, 12, and 16-in. tube spacings. The temperature of the water supplied to the panel could be held constant at any desired value. In general, each series of tests was made with tube temperature held constant, and with absorber temperatures adjusted to produce heat flow rates of the desired magnitude. Temperature distribution and heat flow rates from both sides of the panel were determined for each test.

Tests were made without insulation on the back of the panel and also with 3-$\frac{5}{8}$ in. batt-type insulation, with a nominal conductivity of about 0.27 Btu per (hr) (sq ft) (F deg per in.), laid on the back of the plaster.

Effective Panel Conductance

Following the pattern used previously,[1] the performance of each of panels Nos. 5 and 6 is reported in terms of an effective panel conductance. This is defined as the downward heat flow in Btu per (hr) (sq ft) divided by the difference between the average tube temperature and the average panel surface temperature (F deg), and is a function of the tube spacing and of the ratio of upward to downward heat flow. Performance curves for plaster panels Nos. 5 and 6 are given in Figs. 3 and 4 which show that the panel with good tube embedment, No. 5, has a higher effective conductance than the one with poor tube embedment, No. 6. This comparison may also be seen in Fig. 7 and Table 1. Insulation placed on the back of the plaster did not appreciably change the effective conductance for a fixed ratio of upward to downward heat flow. (See tests with 8-in. tube spacing — Figs. 3 and 4).

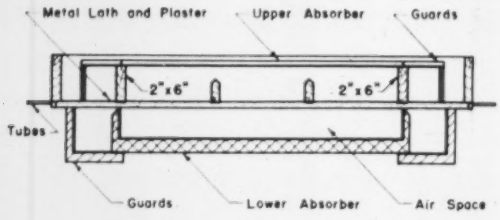

Fig. 2—Sectional view of plaster panel and absorbers

Effect of Back-Plastering

After completion of the initial work on panel No. 6 having poor tube embedment, plaster was applied uniformly to the back of the panel to a depth of 3/8 in. over the tubes. The plaster used was similar to that of the brown (second) coat but included fibrous material. When the plaster was properly cured, tests were made to determine the effect of back-plastering on panel performance.

The experimental effective conductance of panel No. 6 when back-plastered is given in Fig. 4 for an 8-in. tube spacing. This effective conductance is approximately equivalent to that of the same panel with a 6-in. tube spacing without back-plastering.

In the original studies, back-plastering was applied to a depth of about 3/16 in. over the tubes and tapered down to the metal lath. The effect of this back-plastering upon the effective conductance of the panel was about the same as reported here for panel No. 6.

Surface Temperature

The surface temperature along a line perpendicular to the tubes has a regular wave form showing highest temperatures directly below the tubes and lowest temperatures midway between tubes. The surface wave amplitude (half the peak to peak value) depends upon the total heat flow from the panel and is given for various tube spacings in Fig. 5 for panel No. 5, and in Fig. 6 for panel No. 6. Panel No. 5 has the smaller surface wave amplitude for all tube spacings.

Performance Comparison of Six Plaster Panels

Table 1 gives pertinent data on the construction and the thermal characteristics of all six panels and lists the panels in order of decreasing effective conductance. Thermal characteristics may be compared on the basis of effective conductance; this is shown in Fig. 7 based on an 8-in. tube spacing for uninsulated panels. Table 1 and Fig. 7 show that panel No. 6, with relatively poor tube embedment, has a higher conductance than panel No. 1 which had at least average tube embedment. These results emphasize strongly the importance of secure fastening of the tubes to the lath.

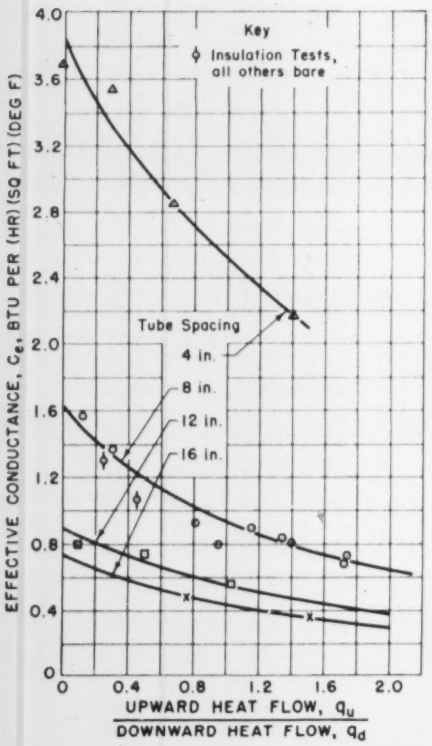

Fig. 3—Experimental values of effective conductance for plaster panel No. 5

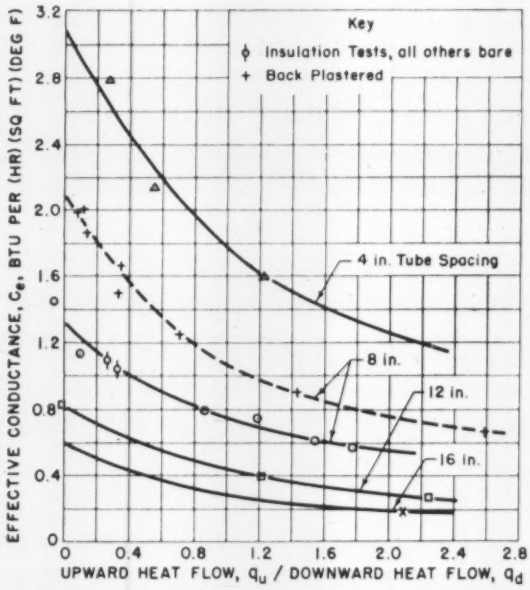
Key
Insulation Tests, all others bare
Back Plastered
4 in. Tube Spacing
8 in.
12 in.
16 in.
EFFECTIVE CONDUCTANCE, C_e, BTU PER (HR) (SQ FT) (DEG F)
UPWARD HEAT FLOW, q_u / DOWNWARD HEAT FLOW, q_d

Fig. 4—Experimental values of effective conductance for plaster panel No. 6

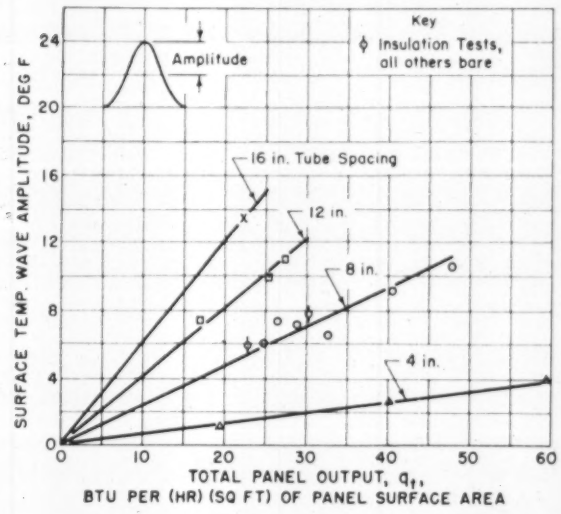

Fig. 5—Surface temperature wave amplitude *vs.* panel output: panel No. 5

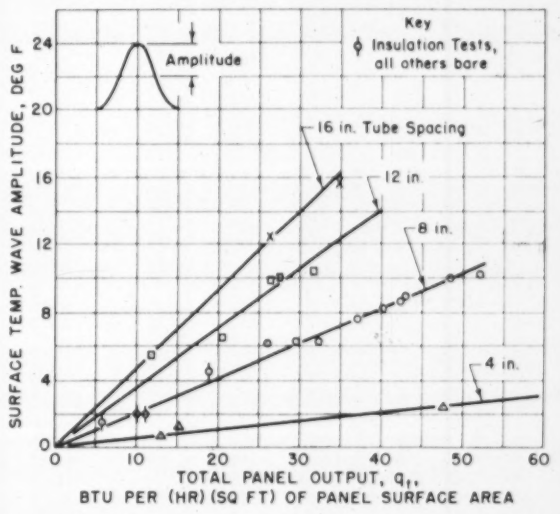

Fig. 6—Surface temperature wave amplitude *vs.* panel output: panel No. 6

Upward Heat Flow

In any application, the downward heat flow and the panel surface temperature requirements are determined by the heating requirements of the space. However, the effective conductance, and therefore the tube temperature, depends upon the ratio of upward to downward heat flow; consequently, it is necessary to know both the upward and the downward heat flow to determine the effective conductance of the panel.

The upward heat flow from the panel may be calculated from knowledge of the construction and insulation above the panel and the temperature difference between the panel and some convenient location above the panel. For precise calculations, it would be necessary to use the temperature at the back of the panel. However, this is never known, and for all practical purposes it is sufficient to use the panel surface temperature which is one of the design criteria.

Application of Results

The results of these studies will permit the design of a heating panel when the required heat output and the panel surface temperature have been determined. The relationship between these two variables must be established for each separate application. Data on the relationship between panel output and panel surface temperature are now being developed at the ASHVE Research Laboratory as part of the overall program on panel heating and cooling; one paper, on ceiling panels, has been published.[4]

Examples 1 and 2 illustrate the use of results from the study herein reported.

Table 1 — Effective Conductance of Plaster Panels
(Listed in order of decreasing effective conductance)

Pane No.	Size and Type[a] of tubing Inches	Location of Tubes	Type of Lath	Depth[d] of Cover Inches	Tubes Wired to Lath	Tube Embedment	Effective Conductance[e] C_e Btu/(hr) (sq ft) (F deg)
2	⅜ nonferrous	Below lath	Expanded metal[c]	⅜	—	Almost complete	1.58
5	⅜ nonferrous	Above lath	Expanded metal[b]	¼	8 inch intervals	Good	1.42
4	⅜ nonferrous	Below lath	Gypsum lath	⅜	—	Almost complete	1.33
6	⅜ nonferrous	Above lath	Expanded metal[b]	¼	8 inch intervals	Poor	1.14
3	½ ferrous pipe	Above lath	Expanded metal[b]	¼	none	Average	1.00
1	⅜ nonferrous	Above lath	Expanded metal[c]	¼	none	Average	0.88

[a]Non-ferrous tube sizes nominal. Ferrous pipe size I.P.S.
[b]Metal lath was diamond type weighing 3.1 lbs per square yard.
[c]Metal lath was flat rib type weighing 2.5 lbs per square yard.
[d]Nominal thickness of plaster under tubes.
[e]C_e = Downward heat flow divided by tube to surface temperature difference. Values are for 8 in. tube spacings, and a ratio of upward to downward heat flow = 0.2.

Example 1: Determine the required tube temperature for a panel which will have a heat output (q_d) of 40 Btu per (hr) (sq ft) with a room temperature of 70 F

Table 2 — Estimated Tube Temperatures for Plaster Panels Without Back Plastering for Conditions Given[a]

Panel Number	Effective Panel Conductance C_e Btu/(hr) (sq ft) (F deg)		Tube Temperature F		
	4 inch Spacing	8 inch Spacing	4 inch Spacing	6 inch Spacing[b]	8 inch Spacing
2	4.13	1.53	109.7	117.9	126.1
5	3.38	1.38	111.8	120.4	129.0
4	3.35	1.29	111.9	121.5	131.0
6	2.66	1.11	115.0	125.5	136.0
3	2.16	0.98	118.5	129.7	140.8
1	2.07	0.86	119.3	132.9	146.5

[a]Panel Surface Temperature 100 F.
Overall Upward Conductance C = 0.1 Btu/(hr) (sq ft) (F deg).
Outside Air Temperature 0 F.
q_u (Upward Heat Flow) = C (Panel Surface Temp. − Outside Air Temp.) = 0.1 (100 − 0) = 10 Btu per (hr) (sq ft).
q_d (Downward Heat Flow) = 40 Btu per (hr) (sq ft).
q_u/q_d (Ratio of Upward to Downward Heat Flow) = 10/40 = 0.25.
None of panels back-plastered.
[b]Linear interpolation of tube temperatures.

and an outside temperature of zero. The overall upward conductance from the panel to the outside air is 0.3 Btu per (hr) (sq ft) (F deg).

For this example it will be assumed that the panel is similar in construction to panel No. 5 of this paper, and that the tubes are on 8-in. centers. It is further assumed that for this particular example, a panel surface temperature of 100 F will be required to give a heat output of 40 Btu per (hr) (sq ft).

The unknowns are the upward heat flow, q_u, and the tube temperature.

Solution: The upward heat flow using the panel surface temperature, 100 F, the upward conductance 0.3 Btu per (hr) (sq ft) (F deg), and the outdoor temperature of 0 F is given by the equation,

$$q_u = C\Delta t = 0.3(100-0)$$
$$= 30 \text{ Btu per (hr) (sq ft)}$$

The ratio of upward to downward heat flow is

$$q_u/q_d = 30/40 = 0.75$$

The effective conductance C_e from Fig. 3 = 1.05 Btu per (hr) (sq ft) (F deg). The tube temperature = q_d/C_e + Panel Surface Temperature

$$= 40/1.05 + 100$$
$$= 138 \text{ F}$$

Example 2: Determine the required tube temperature if all values remain the same as in *Example* 1 except that the overall upward conductance C has been reduced to 0.1 Btu per (hr) (sq ft) (F deg) by adding insulation to the back of the panel.

The upward heat flow is 0.1 (100−0) = 10 Btu per (hr) (sq ft). From Fig. 3 the effective conductance C_e is 1.38 Btu per (hr) (sq ft) (F deg). The required tube temperature is 40/1.38 + 100 = 129 F.

Table 2 shows the required tube temperatures for each of the six panels as calculated for conditions of *Example* 2. It may be seen that the required tube temperatures are approximately the same for the three types of well constructed panels, Nos. 2, 5, and 4. The increase in tube temperature for panel No. 6 is caused by poor tube embedment. Although panels Nos. 3 and 1 had average tube embedment, the lath and tubes were not tied together, and consequently a considerably higher tube temperature is indicated.

The limitations of maximum panel surface temperatures and water temperatures as given in the technical press emphasize the importance of proper panel design and construction.

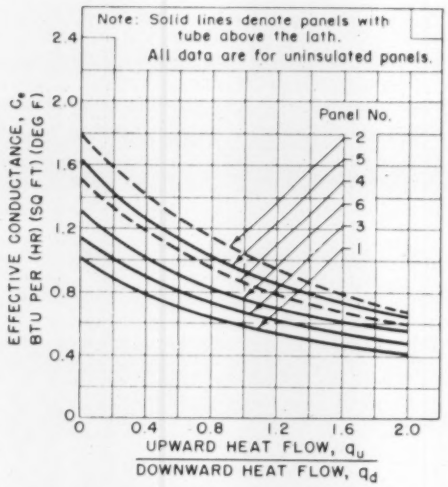

Fig. 7—Effective conductance for six plaster panels: 8-in. tube or pipe spacing

Conclusions

1. The heat transfer within a plaster panel is related to the heat output from the lower and upper surfaces of the panel and can be expressed in terms of an effective conductance. This is defined as the downward heat flow in Btu per (hour) (square foot) divided by the difference between the average tube temperature and the average panel surface temperature in Fahrenheit degrees.

2. For all practical purposes, panel surface temperatures may be used for calculation of the upward heat flow.

3. Insulation on the back of plaster panels serves the following purposes: (*a*) reduces upward heat flow; (*b*) increases the average panel surface temperature for a given tube temperature, or conversely; (*c*) for a given downward heat flow, permits operation with a lower tube temperature than would be required if the panel were not insulated.

4. The addition of back-plastering to panels constructed with tubes above metal lath increases the heat transfer to the panel surface. In general, the heat transfer of a panel with tubes on 6-in. centers without back-plastering is equivalent to that of a panel with tubes on 8-in. centers with back-plastering.

5. It has been demonstrated that for panels having tubes above metal lath, good tube embedment and good contact between tubes and lath are prerequisite to good heat transfer.

References

1. Laboratory Studies of the Thermal Characteristics of Plaster Panels by C. M. Humphreys, C. V. Franks and L. F. Schutrum (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, July 1951, p. 127.)

2. Standard Specifications for Gypsum Plastering A42.1-1946, obtainable from *The American Society for Testing Materials* or *The American Standards Association*.

3. A Low-Inertia, Low-Resistance Heat Flow Meter, by R. G. Huebscher, L. F. Schutrum, and G. V. Parmelee (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1952, p. 111.)

4. Heat Exchanges in a Ceiling Panel Heated Room, by L. F. Schutrum, G. V. Parmelee and C. M. Humphreys (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, December 1952, p. 123.)

Denver's Famous Amphitheater

June Meeting in Mile High City Attracts Members

ACCORDING TO Committee on Arrangements General Chairman Fred Janssen, advance reservation requests indicate a record attendance at the Semi-Annual Meeting June 29, 30-July 1, 1953 in Denver, Colo. The complete program lists 14 papers, and the entertainment scheduled will provide fun and excitement for members and their families.

On Monday there will be a welcome luncheon.

The ladies have a style show and tea planned for them at the Park Lane Hotel. The children are sure to enjoy a tour through the City Park Museum of Natural History and the Zoo.

Among the annual entertainment highlights will be the Golf Tournament with the Research Cup for the individual low net score and the Eichberg Memorial Trophy for the Chapter whose representatives score the lowest three man combined total. As always the Paul Bunyan Cup will be awarded to the holder of the highest 18 hole gross total.

Monday night will feature a Good-Time Party for members and their guests. The theme will be the *Gold Rush Days* with miners, prospectors, gamblers, cowboys and Indians out in full force, which means fun and surprises for all.

Tuesday morning will be devoted to the Ladies Theatre Party which will include a matinee performance of the opera *Carmen* at the Central City Opera House. The afternoon will feature a mountain tour of 100 miles of Rocky Mountain scenery ending with a delicious western-style supper in the evening.

Elitch Theater located in the well-known Elitch Gardens

Wednesday afternoon the children will journey to Elitch Gardens for a round of rides and amusements. A special matinee party at Elitch Gardens Summer Theater is also scheduled for the ladies. In addition a complete program of sports and scenic drives will be available at all times for members and their guests.

As a fitting climax to the three days of ASHVE activities, the Semi-Annual Banquet will be held on Wednesday night in the Lincoln Room of the Shirley-Savoy Hotel.

Many other interesting events plus the exciting scenic wonders of Colorado combine to make the June Semi-Annual Meeting a wonderful vacation for members of the Society. The Rocky Mountain Chapter is *rolling out the red carpet* for a real Colorado welcome.

Have you made your reservations? Have you selected your mode of transportation? Are you getting ready for a wonderful time in Denver, the Mile High City?

PROGRAM — 1953 SEMI-ANNUAL MEETING

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Shirley-Savoy Hotel, Denver, Colorado
June 28 to July 1, 1953

Saturday — June 27

10:00 a.m. Finance Committee Meeting
2:00 p.m. Council Meeting
2:00 p.m. Committee on Research

Sunday — June 28

10:00 a.m. REGISTRATION, Shirley-Savoy Hotel, (Lincoln Street Annex)
10:00 a.m. Committee Meetings
10:00 a.m. Committee on Research
2:00 p.m. Sightseeing tours of City (Private cars)
4:00 p.m. Chapters Conference Committee Meeting

Monday — June 29

9:00 a.m. REGISTRATION, Shirley-Savoy Hotel, (Lincoln Street Annex)
9:30 a.m. FIRST TECHNICAL SESSION
Call to Order by Pres. Reg. F. Taylor
Performance of a Forced-Draft Cooling Tower, by B. H. Spurlock, Jr.
Effect of Relative Humidity on Heat Loss of Men Exposed to Environments of 80, 76 and 72 F, by T. Inouye, F. K. Hick, M. D., S. E. Telser, M. D., and R. W. Keeton, M. D.
Experimental Approaches to the Study of Noise and Noise Transmission in Piping Systems, by W. L. Rogers
12:00 Noon Welcome Luncheon
1:30 p.m. Golf Tournament — Lakewood Country Club
Research, Eichberg and Paul Bunyan Cups
2:30 p.m. Ladies Style Show and Tea — Park Lane Hotel
1:30 p.m. Children's Entertainment
City Park Museum of Natural History and Zoo
7:00 p.m. Good-Time Party — (Shirley-Savoy Hotel, Lincoln Room)
Gold Rush Days with Miners, Prospectors, Gamblers, Cowboys and Indians — Dress informal

Tuesday — June 30

9:00 a.m. REGISTRATION, Shirley-Savoy Hotel, (Lincoln Street Annex)
9:30 a.m. SECOND TECHNICAL SESSION
Electrical Analogger Application to the Heat Pump Process, by C. F. Kayan
Design and Performance of a Residential Earth Heat Pump, by Merl Baker
Moisture Movement in Soils Due to Temperature Difference, by W. A. Hadley and R. Eisenstadt
12:00 Noon Nominating Committee
12:30 p.m. Ladies Theater Party
Matinee performance of the opera "Carmen" — Central City Opera House. This group will join the others at the Western supper.
2:00 p.m. Mountain Tour and Supper
100 miles of Rocky Mountain scenery ending with a delicious western-style supper with free entertainment at 6:30 p.m.

Wednesday — July 1

9:00 a.m. REGISTRATION, Shirley-Savoy Hotel, (Lincoln Street Annex)
9:30 a.m. THIRD TECHNICAL SESSION
Design Data for Slat-Type Sun Shades for Use in Load Estimating, by G. V. Parmelee and D. J. Vild
Automatic Permeance Testing by the Permeometer, by F. A. Joy and A. W. Sherdon
Thermal Performance of Frame Walls, Part II — Air Spaces Blocked at Mid-Height, by G. O. Handegord and N. B. Hutcheon
*Development of Thermal Conductivity Probe, by F. C. Hooper and S. C. Chang
1:30 p.m. FOURTH TECHNICAL SESSION
Performance of Warm Air Perimeter-Loop and Perimeter-Radial Systems in a Residence, by H. T. Gilkey, R. W. Roose and M. E. Childs
Heat Exchanges in a Floor Panel Heated Room, by L. F. Schutrum, G. V. Parmelee and C. M. Humphreys
Further Studies of Thermal Characteristics of Plaster Panels, by L. F. Schutrum and C. M. Humphreys
*Heat Flow Analysis in Panel Heating or Cooling Sections, Case II — Floor Slab on Earth with Uniformly Spaced Pipes at the Slab-Earth Interface, by H. B. Nottage, C. V. Franks, L. E. Hulbert, and L. F. Schutrum
1:30 p.m. Ladies Matinee Party
Elitch Gardens Summer Theater matinee. Children will also go to Elitch Gardens for an afternoon of rides and amusements
7:00 p.m. Semi-Annual Banquet (Shirley-Savoy Lincoln Room)
Climax of the meeting. Short program followed by dancing.

*To be presented by title.

Method of Choosing Location of, Financing and Conducting Meetings of the Society

Resolved: That inasmuch as the Annual and Semi-Annual Meetings of the Society come under the jurisdiction of the Council, the following rules governing the handling of such meetings be adopted by the Council and published in the JOURNAL of the Society at least twice during every year, preferably just prior to each meeting.

1—The Council will select the city in which the Annual or Semi-Annual Meeting is to be held, giving due consideration to the invitations received from Chapters or members as well as to the advisability of so distributing those meetings as to make them of the greatest advantage to the general membership, and to reduce as far as possible the expense of members attending.
2—That an appropriation be made to cover the entertainment or local expenses, incurred in connection with the meeting, and the regular meeting expenses to be taken care of by the General Fund of the Society in the regular way.
3—That no registration fee or compulsory obligations of any nature be imposed on members or guests.
4—That the purchase of tickets for banquets or for any other form of entertainment that may be provided be entirely voluntary.
5—That the grouping of features and the sale of tickets for group features be discouraged.
6—That the raising of funds from manufacturers of heating apparatus be discouraged.
7—That the display of samples, or of literature, advertising the product of any manufacturer in any way, shape or form, be not permitted at the booths, registration desk, or in or about the meetings.
8—That the distribution of trade papers be entirely at the discretion of the committee in charge.
9—That the local Chapter or local members be empowered to form a General Committee with such sub-committees as may be required to handle the details of transportation, hotel accommodations, entertainment, finance, etc., and that this General Committee be requested to confer frequently with the Council, through the Executive Secretary of the Society, and to make frequent reports on progress in connection with the various matters being handled by them.
10—That the arrangements of elaborate and costly entertainment features be discouraged.

Adopted at Council Meeting, January 29, 1926.

Basic Odor Research Correlation Conference

New York, N. Y. — April 23-24, 1953

TWENTY-FIVE papers on odors and odor perception were presented at a two-day meeting held April 23-24, 1953, in the Barbizon-Plaza Hotel, New York. The Conference was sponsored jointly by ASHVE and the New York Academy of Sciences.

A special feature of the conference was its comprehensiveness in providing opportunity for discussion of odors, their perception and effects, by engineers, biologists, chemists, physiologists and psychologists. No preceding conference on odors had included such a wide scope, and consequently this meeting served as a means of informing each group about the activities of the others. An indication of the wide appeal of the conference can be obtained not only from the attendance of 324 persons having vital interest in odor problems, but also from the range of subjects. These dealt with definition, classification, abatement, and control of odors from the engineer's and chemist's viewpoints; perception and transmission in the olfactory system of humans and animals (as well as insects) from the physiologist's and entomologist's viewpoints; and the effects on nervous systems and mental processes from the psychologist's viewpoint.

Sources of Papers

Papers presented at the Conference were obtained from research conducted in college laboratories such as Syracuse University, Department of Plant Sciences; Florida State University; Columbia University, Barnard College; Cornell University, Agricultural Experiment Station Laboratory of Enzyme Chemistry; Brown University; Yale University, School of Medicine, Departments of Psychology and Physiology; Institute of Living, Department of Neurophysiology, Hartford, Conn.; Johns Hopkins University, Department of Biology; Purdue University, School of Electrical Engineering; Tufts College; Northwestern University, Medical School; and University of Pittsburgh, School of Medicine.

Other papers were obtained from manufacturing and research organizations including Dorn & Co.; Liggett & Myers Tobacco Co.; Fritzsche Bros.; Process & Instruments; York Research Corp., Airkem, Inc.; Foster D. Snell, Inc.; York Corp.; Connor Engineering Corp.; Arthur D. Little, Inc. One paper was obtained from the Medical Division, Civil Aeronautics Administration.

Introduction

A. A. Behnke, Capt. (M.C.) U.S.N., was general chairman and also acted as conference chairman due to the illness of T. H. Urdahl, chairman of the ASHVE Technical Advisory Committee on Odors.

After Captain Behnke had stated the objectives of the Conference by prophesying a review of its accomplishments as it might be written in 1983, Cyril Tasker, ASHVE director of research, reviewed briefly the growth of Society interest in the odor problem as shown by the activities of the Committee on Research and its Technical Advisory Committee on Odors, as well as by the preparations made for odor research in two special rooms constructed in the ASHVE Research Laboratory.

Program

First Session, Thursday, April 23
The Odor Problem in Industry and Sciences: A. B. HUBBARD, *Chairman*

A. Basic Types of Industrial Odor Problems

1. The Problem of Off Odors in Tobacco (Crop to Package), by *F. R. Darkis*,* E. J. Hackney, W. W. Bates and Lee Leiserson.
2. The Problems of Controlling Odors in Processing Protein Foods, by H. W. Dorn.
3. The Nature of the Odor Problem in the Paper Industry, by Ernest Reed.
4. Odor Modifiers, by Ernest Lawson.

B. Problems of Odor Research from the Viewpoint of the Scientist

5. The Physiologist, by L. M. Biedler.
6. The Psychologist, by Bernice M. Wenzel.
7. The Physicist, by Joseph Greenspan.
8. The Chemist, by J. B. Sumner.
9. Odors, Odorants and Deodorants in Aviation, by C. R. Spealman (presented by title).
10. Hotel Odor Problems, by E. J. Kenney (presented by title).

Second Session, Thursday, April 23
The Olfactory Process, Status of Present Knowledge: AMOS TURK, *Chairman*

11. The Odorants, by R. W. Moncrieff.
12. Receptor Mechanism — The Olfactory Area and the Olfactory Receptor Mechanism, by Jean Mateson.
13. The Neural Apparatus Underlying Olfactory Perception, by Carl Pfaffmann.
14. Functions of the Olfactory Brain, by *Lawrence Kruger* and Karl Pribram.
15. The Physiology of Olfaction in Insects, by V. G. Dethier.
16. An Information Theory of Olfaction, by *R. M. Hainer*, A. G. Emslie and Ada Jacobson.

Third Session, Friday, April 24
The Status of Subjective and Objective Measurement Techniques: A. HALDANE GEE, *Chairman*

17. The Validity of Practical Odor Measurement Methods, by R. L. Kuehner.
18. Scheme for Odor Identification with Examples of Its Use, by *L. C. Cartwright* and P. H. Kelley.
19. Odorous Atmospheric Gases and Vapors: Properties, Collection and Analysis, by Amos Turk.

*When more than one author, presentation was made by one whose name appears in Italics.

20. Study and Evaluation of Odor Properties of Surfaces, by *Nicholas Deininger* and Frederick Sullivan.

21. Observations on Olfactory Intensity Using Psycho-Physical Scaling Procedure, by L. H. Beck, *Lawrence Kruger* and Paul Calabresi.

Fourth Session, Friday, April 24

Experimental Studies in Odor: G. W. MEEK, *Chairman*

22. Surface Phenomenon Related to Odor Measurement, by *J. R. Eaton*, J. E. Christian and J. A. Campbell.

23. Olfactory Nerve Potentials -- A Direct Measure of Chemoreception in Insects, by Chester Roys.

24. Use of Odor in Experimental Neuroses with Monkeys, by *Jules Masserman* and Curtis Pechtel.

25. The Influence of Age on the Threshold of Olfactory Perception, by I. A. Mirsky and Elsa Strauss.

Contents of Papers

A brief reference is made in following paragraphs to the content of some of the papers resulting from research with which the practicing engineer is usually not familiar. The numbering of the paragraphs corresponds to the number preceding the paper in the program:

Paper No. 3: Special care is required in producing papers which are to be used in containers where any off-odor may be declared as adulteration and may be considered undesirable by the consumer of the food. Odors in paper are also indicative of defective mill operation practices, such as excessive use of chemicals, or the use of chemicals in the wrong place, or under wrong conditions. These odors may be the result of growth of organisms in the mill system, and may be responsible for costly shut-downs, or the production of paper not suitable for the market. Odors in paper may also be due to storage near contaminated material.

Paper No. 5: An important question under consideration is to determine how a group of olfactory cells can detect minute concentrations of substances foreign to its environment, and how the cells can differentiate one substance from another. This problem cannot be solved until the physiologist determines how many types of olfactory end organs are involved in the perception of odors, and how they differ in their responses to a large number of odoriferous materials.

Physiologists generally agree that a study should be made of the responses of single sensory units to a given stimulus, and in particular that the electrical nerve impulses from a single olfactory primary neuron should be recorded as various odoriferous substances stimulate olfactory end organs. Since the olfactory nerves in mammals are usually very short and inaccessible, no one has succeeded in recording an impulse in an olfactory nerve of a mammal. A further difficulty arises from the small diameter of the individual olfactory nerve fibers and the consequent small amplitude of the electrical nerve impulses. It is possible that the opossum possesses sufficiently long olfactory nerves to make electro-physiological recordings possible.

After a single olfactory nerve preparation is found it will be possible to gain further insight into more problems, *i.e.*, the physical and chemical properties common to the odoriferous substances that stimulate a given olfactory unit. Also, it will be possible to determine how responses differ with mixtures instead of single substances, and whether there are substances which, when present in a mixture, will prevent the response of the olfactory unit to the stimulus of the other components.

Paper No. 6: In odor research from the viewpoint of a psychologist the type of research would depend largely on the specialty of the psychologist. The physiological psychologist wants to know how the receptor system functions, what the thresholds of sensitivity are, the laws of mixtures, adaptation, contrast, masking, and related measurements. The comparative psychologist would be interested in these same topics when referred to non-human forms as well as in the trends shown throughout the animal kingdom. Possible effects of odors on interpersonal relations, especially in groups, would constitute the problems of the social psychologist. The applied psychologist working in industry finds himself studying consumer acceptance as a function of product odor and exploring the effects of odors used in advertising. From the viewpoint of the clinical psychologist, the main questions are concerned with abnormalities in olfactory sensation, the ability of odors to evoke early childhood memories, possible therapeutic uses of odors, changes in sensitivity with age, and others of this nature.

Paper No. 8: Numerous schemes have been constructed whereby odor receptors are claimed to be stimulated by infra-red radiations, or else by cooling effect caused by the absorption of the subject's infra-red radiations by the substances smelled. These theories appear to be disproved by the finding that stereoisomers have different tastes but possess identical infra-red spectra. From a survey of the literature the author concludes that none of the present theories of odor perception are acceptable, and that what is needed is more experimental work and less theorizing.

Paper No. 11: Odorant materials come from many sources, some from the animal kingdom and others from a variety of roots, stems, leaves and flowers of plants. The early chemists were capable of producing some olfactory surprises, but the modern synthesists have made a bewildering variety of odorants. Man's olfactory apparatus has proved to be surprisingly capable of dealing with this influx of new material, but sometimes has found itself in considerable difficulty in determining why some compounds which are so similar chemically smell so differently, and why others so diverse to the chemist smell so much alike.

To be odorous at all a material must satisfy two conditions: (1) it must be volatile and, (2) it must be soluble in the tissues of the nasal apparatus. However, some substances satisfy both of these conditions but do not have an odor, water being typical of such substances.

Paper No. 13: Recent experimental work based on electrical recordings from the olfactory bulb of animals indicates that in the neural apparatus each receptor element responds only to certain stimulae.

Paper No. 15: The study of olfaction is little more advanced today than it was at its inception. The foremost obstacle to research has been the inaccessibility of the vertebrate olfactory receptor area and the difficulty of selecting a useful criterion of response. Insects offer several advantages as subjects with which to study olfaction. In 1935 it was first agreed that the source of sensation was in the antennae of insects. This led to further studies in the perception of odors by insects. The location of the olfactory receptors in the antennae and the finding that modified thin-walled hairs were the receptors, shifted attention to the measurement of acuity by the method of acceptance and rejection thresholds.

Paper No. 16: An attempt has been made to imagine a nerve network that would indicate how information about odors might be transmitted to the brain. In examining the body for apparatus that could handle information about odors, it was found that each nostril has a lobe about as big as the end of the thumb. The lobe is made up of about 1900 glomeruli (telephone exchanges) from each of which 24 nerve fibers or neurons go to the brain.

The 24 neurons may be likened to a board with 24 lines. By turning on some of the lines a recognizable picture can be formed. If, for instance, chloroform is smelled, certain neurons in each 24 are stimulated and announce the odor of chloroform to the brain. With only 24 neurons it is possible to get 16 million different patterns corresponding to 16 million different odors. The kind of odor depends on the pattern, but the strength

of the odor depends on the number of bundles of 24 neurons each which react to the chloroform. The reaction depends on the quantity of the chloroform in the air. It has been computed that the human olfactory equipment permits the discrimination of about 30 concentrations.

It has been concluded that the bundles of 24 neurons differ from a board with 24 electric lights in that the neurons send electrical impulses to the brain at 10 times a second.

Paper No. 19: Many practical odor problems involving the tracing of odors to their sources, and methods for their control must ultimately be solved by actual identification and isolation of components for individual study. Odorants may be collected by condensation, sorption and solution with and without chemical reaction. Components of samples may be separated by physical, chemical and spectrometric methods. Atmospheric odorants are such complex mixtures that a spectral analysis for complete identification of components can be made only after some preliminary fractionation.

Paper No. 20: While metal surfaces are not usually considered to be retainers of odors, they vary considerably in regard to surface pickup, release, and retention of odors. Various metals, plastics, and fabrics have been rated in regard to odor retention. Decontamination of surfaces of metals or other materials used in construction of odor study equipment is often a difficult process.

Paper No. 22: It is reasonable to approach the study of odor measurements by investigating general methods of measuring air contamination. The surface tension of many liquids changes appreciably in the presence of minute air contamination. Use of these characteristics was possible by measuring surface tension by the pendant drop method to detect the presence of odorous materials such as camphor, cloves, rubber, etc. Tests conducted indicate the possibility of using this method under carefully controlled conditions to detect the presence of odor-producing materials.

Paper No. 23: A study of olfaction by examination of potentials in the olfactory nerve is a direct approach to investigation of the receptor mechanism without modification by higher nerve centers. It has an advantage over studies of the behavioral responses of animals to odors and even responses of the human subject, which may be distorted by central nervous system phenomena such as previous conditioning. Many insects have most of their olfactory receptors located in the antennae, and consequently insects such as a cockroach, having long antennae, can be used (because of the easily accessible and long olfactory nerves) to study the impulses caused by odor-producing materials. Responses to various odorous chemicals have been studied in the American cockroach, and thresholds of response have been determined.

Paper No. 24: By means of experiments on monkeys, it was found that an odor is relatively attractive to an animal when it is spontaneously related to some satisfactory experience such as normal feeding. It becomes unacceptable when it is associated with an unpleasant experience. This was proved by subjecting monkeys to the unpleasant experience of finding a snake in the box of food which had been given an odor which ordinarily did not produce any reaction. The monkey associated the odor with the unpleasant experience, and would therefore refuse to accept food having the same odor until the monkey had been submitted to a long period of recovery from its original fear. It was possible to effectively neutralize the normal and neurotic olfactory reactions of monkeys under experimental conditions by use of one of a number of commercially available deodorant compounds.

Paper No. 25: The change of olfactory perception with age was indicated in experiments with 614 subjects of ages from 8 to 85. A progressive increase in olfactory perception thresholds was noted from age 8 to approximately age 25, after which the thresholds remained relatively constant. After approximately 50 years of age, the thresholds decreased progressively to that observed before 20 years of age. In order to evaluate the significance of changes in perception, the effect of aging on olfactory perception was compared with the effect of aging on vibratory perception. From such comparison it was inferred that whereas the diminution in vibratory acuity is determined primarily by physiological factors, the change in olfactory perception is influenced significantly by psychological factors.

Conference Committee

The plans for the Conference were made by an Organizing Committee composed of representatives from the ASHVE Technical Advisory Committee on Odors and from the New York Academy of Sciences as follows: T. H. Urdahl, Chairman; W. N. Witheridge, Lloyd H. Beck, N. E. Berry, V. G. Dethier, A. Haldane Gee, Walter A. Grant, A. F. Hubbard, M. G. Kopac, H. Koprowski, George W. Meek, Sherman Ross, R. G. H. Siu, Amos Turk.

The papers presented at the meeting will be published by the New York Academy of Sciences, and will be available three months after the manuscripts of the papers have been submitted to the Academy, probably by August 1.

Due to the success of the conference, it is anticipated that representatives of the sponsor organizations will meet after the papers have been published to consider action which may be desirable to promote further progress.

R. C. JORDAN AND A. J. HESS TO PRESIDE AT ASRE SEMI-ANNUAL

The Lake Placid Club, situated in the historic Adirondack Mountains of New York, has been selected by *The American Society of Refrigerating Engineers* for its 10th Semi-Annual Meeting to be held June 28-July 1, 1953. The Club provides excellent facilities for a combination technical meeting and vacation trip for *ASRE* members and their families.

Registration will commence on Monday, June 29 at 9 a.m. The program will consist of three technical sessions and two conferences which include a wide variety of topics. The Program Committee, headed by J. Robert Hornaday, Deep Freeze Division, Motor Products Co., Chicago, Chairman, and Walter A. Kuenzli, Crosley Division, Avco Mfg., Cincinnati, Vice Chairman, has provided a widely diversified list of papers of interest to refrigeration engineers. The ever popular Domestic Refrigerator Engineering Conference, under the leadership of Russel W. Ayres, Seeger Refrigerator Co., St. Paul, is going to discuss various design features of the chest and upright home freezers. Pres. R. C. Jordan, professor and head of the department of mechanical engineering, University of Minnesota, Minneapolis, Minn. and Vice Pres. A. J. Hess, president, Hess-Greiner & Polland, Los Angeles, Calif., will preside at the meeting.

Residential Air Conditioning Conference Attracts Large Group

Bethlehem, Pa. — April 24-25, 1953

AT A CONFERENCE on Year 'Round Residential Air Conditioning held at Lehigh University on April 24 and 25, 1953 attended by over 175 engineers, builders, manufacturers, research men and contractors, a number of industry and building spokesmen outlined some of the problems confronting the profession in developing to its fullest extent the market for residential air conditioning.

Recognizing the growing importance of year 'round air conditioning to the home owner, the equipment manufacturer, and research groups, the conference brought together members of these groups for the purpose of exploring areas in which further research and development are needed.

Friday Morning Session

The first speaker at the Friday morning session was N. A. Cole, Austin, Tex., head of the Air Conditioning Section of the *National Association of Home Builders*. Mr. Cole outlined some of the problems which confront the home builder in producing for the mass market. Three primary considerations in his opinion were: (1) Does it work? (2) Does it interfere with other construction details? (3) Is it inexpensive enough to be worthwhile? He remarked that the *NAHB* had noted a trend toward forced warm air and gas fired systems for winter heating, and compression type refrigeration units for summer cooling. He questioned whether precise engineering calculations were worthwhile for the small home when there was such a large number of variable factors to be considered, often the result of improper or haphazard construction methods.

Mr. Cole contended that year 'round air conditioning was not feasible if the cost of operation and maintenance ran above ten dollars per month because of the difficulty of obtaining mortgage money.

Other problems which Mr. Cole considered important were the desire of home owners for picture windows, roof over-hang, and trees. Although most homes are insulated, allowances must be made for poor construction and poor workmanship. He felt that present indications pointed to the package units which avoided the necessity of dealing with so many trades and speeded installation.

He concluded by stating that most builders are ready to increase their number of installations and foresaw a big growth of year 'round systems during the next few years.

The second speaker was R. S. Dill, Washington, D.C., chairman of the ASHVE Committee on Research. Mr. Dill outlined the organization of the Society research under the Research Committee and the Technical Advisory Committees. He pointed out how the Research Committee and the TAC's work closely with the Guide Committee in the preparation and revision of the various chapters in the HEATING, VENTILATING, AIR CONDITIONING GUIDE.

Mr. Dill presented a series of slides which illustrated the source of research income, and how these funds are used both in the Society's Research Laboratory in Cleveland, and in the various cooperating institutions. He outlined some of the projects now under way at the Society's Laboratory and some of the work which was expected to be undertaken in the immediate future and the functions of the TAC's in planning and supervising these projects.

Prof. M. K. Fahnestock, research professor of mechanical engineering at the University of Illinois, Urbana, presented a review of current research at the University. He outlined the research that has been done in heating, ventilating, cooling, and air conditioning in the University's research residences. This work has been done by the University in cooperation with a number of organizations, in addition to the Society, including the *National Warm Air Heating and Air Conditioning Association*, and the *Institute of Boiler and Radiator Manufacturers*. In these studies consideration has been given to the technological factors, including mechanical equipment design; and to the physiological effects of environment.

In the several research residences used at the University, every effort has been made to duplicate actual living conditions in the average home. Residences of varying types of construction, including two-story, one-story, with and without insulation, with and without basements, and with several types of heating, cooling and distribution systems have been tried. The results of this continuing research have appeared in the JOURNAL and TRANSACTIONS of the ASHVE, in research bulletins published by the University, and in trade journals.

The studies of the physiological effects of environment at the University Medical School have observed the effects of sudden temperature changes on various groups, including healthy young men and young women, cardiac patients, obese people, and many other groups.

Professor Fahnestock described some of the future fields of research which might well be considered. These included air conditioning for cars, airplanes, and most important, the *psychological* as well as the *physiological* effects of environment on people.

Friday Afternoon Session

The afternoon session presented F. W. Deady of the Bryant Heater Division of Affiliated Gas Equipment, Inc., who spoke on load calculations for residences. Mr. Deady stated that comfort conditions were determined from the comfort chart in THE GUIDE. Mr. Deady outlined the methods of computing the instan-

taneous heat load when divided into simple heat and latent heat. He stressed the importance of solar radiation and the angle of incidence of the sun and the concentration of roof over-hang and shading from trees. He urged the use of the sol-air thermometer as outlined in THE GUIDE. He felt that a most important consideration was having the designer and owner work together in the planning and layout of a system.

The final speaker of the afternoon was R. W. Roose, research assistant professor of mechanical engineering, University of Illinois, who discussed comparison of actual and calculated loads for residences. He described the several research residences which have been used at the University of Illinois. The present research is being conducted at Research Residence No. 2, a one-story, ranch-style home with basement, with 1,040 sq ft of floor area. Under the methods outlined in THE GUIDE, the cooling load for this residence was calculated and compared to the actual load as developed from experience. It was discovered that at peak conditions the actual load exceeded the design load because the wet bulb temperature exceeded design conditions. Studies indicate that the time lag for heat flow through attic and ceiling is only about 3 hr compared to 5 hr suggested in THE GUIDE. This discrepancy between the calculated and actual time lag also was noted for the west and south wall loads. Studies are continuing at Research Residence No. 2 which will include the operation of the cooling system with an added load due to occupants.

Friday Evening Session

The evening session of the Conference was preceded by a dinner held at the Hotel Bethlehem. The toastmaster for the evening session was Dr. H. A. Neville, director, Institute of Research, Lehigh University, who presented the moderator for the panel, O. H. Spillman, architect, and president of the Bethlehem Chamber of Commerce.

The first panel speaker was C. O. Christenson, assistant director of research of the *NAHB*. Mr. Christenson compared engineering aims and design as opposed to field practice. He felt that an important consideration was the cost of air conditioning systems, and stated that the *NAHB* is very much interested in the development of this field. Mr. Christenson felt that some parts of the country were much more conscious of the need for air conditioning in the residential field than others, but he foresaw residential air conditioning unanimously accepted in the not too distant future.

The second panel member was R. J. Johnson of the United States Public Health Service, who stated that the Public Health Service had outlined 32 principles for maximum comfort and health of the general populace. The first three questions were concerned with the heating and air conditioning field and included the maintenance of thermal environment and the maintaining of pure and healthful air within the home. He felt that one great problem was the achieving of optimum conditions in middle and low income groups.

H. R. Sleeper, New York architect, stressed the importance of architects and engineers working together. Architects should plan a home from the inside, because the condition has now been reached where the engineer can furnish any climate desired. As consideration is given to the completely air conditioned home, new possibilities for its layout are feasible. Among these are: (1) central core with kitchen, bath and utilities located at the center of the house, and the living and recreation quarters on the outer circumference; (2) angles and corners and the necessity for cross ventilation are no longer important; (3) glass all around or no glass at all; (4) building of houses below grade; and (5) in housing developments, houses can be built close together with the use of solid end walls.

The final panel speaker was Mrs. H. R. Sleeper, interior decorator, who pointed out the savings to the housewife in time and work with the use of air conditioning systems. With clean, filtered air and closed windows, airborne dirt can be almost eliminated, and thus eliminate the soiling of furniture, walls, etc. The improvement is also apparent in better sleeping and the elimination of street noises. Mrs. Sleeper felt that the advantages of air conditioning will bring about healthier and happier humans.

Saturday Morning Session

At the Saturday morning session the first speaker, C. W. Nessell, account executive, Minneapolis-Honeywell Regulator Co., Chicago, spoke on *Vapor Problems*. Based on his own experience, Mr. Nessell outlined some typical problems which he had encountered in the field with the presence of vapor in the home. He described one home with a relative humidity of 70 percent in which mildew and moisture were prevalent throughout, although the air conditioning unit appeared to be adequately sized. The crawl-space was discovered to be full of mud and moisture, and the difference in vapor pressure was permitting the moisture from the crawl-space to creep into the house. In this case the problem was solved by heavy roofing paper which was placed on the ground in the crawl space. Mr. Nessell stated that no possible source of moisture should be overlooked. Dehumidification by the air conditioning unit is particularly important in the modern, small, tight house.

A panel group of W. A. Grant, director of research, Carrier Corp., Syracuse, N. Y.; W. G. Senft of the American Radiator and Standard-Sanitary Corp.; and G. R. Wachter, York Corp., York, Pa., outlined the problems in the control and operation of air conditioning systems, and divided them into six parts.

Mr. Grant spoke on the first problem, physiological considerations, and stated that the improvement in health is not the primary consideration with air conditioning — comfort is the most important aspect, and a good night's sleep can often bring a better day's work. In designing any system, it is important to consider the clothing of the people who are occupying the space, the type of work, their age, activities etc. In view of present practices, it is desirable to

design for as little air motion as possible. Air purity of itself is adequate with the presently designed systems. He outlined a series of 13 possible areas of study for the future, including research in physiological and psychological factors of air conditioning; the adequacy of the ASHVE comfort chart; and the noise problem.

The second aspect of the problem, heating equipment, was presented by W. G. Senft. Mr. Senft referred to the work which has been done at the University of Illinois on warm-air heating, and that which has been conducted by the Society. It was his opinion that the greatest comfort is possible when the heating equipment is properly sized, and operates almost continuously at design conditions. He felt that continuing research was needed on friction in ducts, fittings, and in the design of more compact equipment.

Mr. Wachter outlined the third part of the problem, selection of cooling equipment. The air conditioning unit can be considered as a pump which expels heat from the residence. He felt that the thermostat on cooling equipment should be primarily a low temperature cut-off, and the maintaining of 7 to 9 deg temperature range might be desirable. In this way, a conditioner would start early in the morning and operate continuously until evening when it would be well ahead of the load. For the average residence he did not think a humidistat was justified. Electrically speaking, he thought that the small, hermetically sealed units offered the most favorable operating characteristics.

Mr. Senft presented the fourth part of the problem, temperature control. He felt that electronic controls were excellent, but were not yet feasible for the mass market. A short frequent operating cycle for a unit is most desirable. Mr. Senft said that ideal summer and winter thermostat location might not be the same. He pointed out that air stratification seems as undesirable in summer as in winter. Although infrequent operation of a cooling unit can build up the cooling capacity of the building, it is advisable to have the unit sized to operate almost continuously in order to keep the humidity at a comfortable and safe level. He felt that the greatest possibility for research was in the simplification of systems to make them easier for the installer and home owner.

Mr. Grant presented the fifth part of the problem, summer humidity. He stated that moisture loads are often improperly computed and that many times the heavier humidity load comes on damp, rainy days, cool days with a low cooling load. In addition to this, reevaporation from the coil causes increase of moisture load when the unit has frequent off periods. He felt that the most important aspect of this was the determination of methods of reducing the moisture load.

Mr. Wachter concluded the discussion by outlining the economics of the problem, using several installations as examples. He pointed out that the actual operating time of units was often less than expected. If a unit is oversized, the off periods will permit too great a humidity rise. Three considerations of cost are: (1) improved construction to reduce cooling loads, and the reduction of heat gain due to sun effects; (2) improvement of cooling equipment — sizing of equipment for proper operation (consideration might be given to zoning); and (3) extension of summer conditioning by the use of outside air for ventilation during the heating/cooling season in fall and spring.

W. F. Friend, mechanical engineer with Ebasco Services, Inc., New York, discussed the importance of water power and fuel considerations in year 'round air conditioning. He stated that during the next few years there was no likelihood of lower electric rates, and the load factor for electric service is important. It is important to design for single phase operation insofar as possible, and to reduce the number of starting and stopping times in each hour and thus reduce the load on electric lines. The use of natural gas as a fuel is increasing and former limitations on its use for heating will be reduced. The storing of gas underground during the summer, close to the market, is increasing. Progress is also being made on the underground gasification of coal reserves, and increasing use is being made of natural gas from the Canadian fields. However, water scarcity in many communities is increasing, and consideration is being given to the use of reclaimed sewage for potable water. In some ways air conditioning water can help the sewage system by carrying solid refuse from garbage disposal units.

Mr. Friend briefly described the possibilities of nuclear power, which appears to be technically possible, but is not yet proved to be economically sound. In any event the populace should not look for any overnight revolutionary developments because of atomic energy.

The final talk and summation for the program was given by J. R. Hertzler, vice president of the York Corp. In his summarization, Mr. Hertzler outlined the purpose of the conference, and the various speakers' talks. He pointed out the home problems in the demand *vs* supply and the present estimated deficit of 300,000 homes per year. He summarized the research being done by the Society and the University of Illinois in the air conditioning field. Some questions that the conference had brought out were: (1) How much recirculation air should be used in year 'round systems? (2) Does the duct stat offer the ideal cooling system control? (3) Where should vapor barriers be located? (4) Should there be humidity controls? (5) Calculated *vs* actual moisture load. (6) The hygroscopic capacity of furniture and furnishings. (7) Should there be exhaust vents for bathrooms?

In conclusion, Mr. Hertzler stressed the desirability of coordinating market research which would show the real summer and winter air conditioning needs from Miami to Minneapolis. He felt that it was important to consider the market for year 'round conditioning systems. The industry is growing rapidly and their areas of interest and influence are increasing constantly.

Summary of Chapter Meetings*

• *ARKANSAS*: J. C. Lewis introduced the guest speaker, V. F. Self, sales promotion, Anemostat Corp. of America, New York, N. Y. Mr. Self spoke on *Behavior of Air* and presented a film on *Air Diffusion*.

A social hour and dinner preceded the April business meeting which was called to order by Vice Pres. R. E. Blaylock. The treasurer presented his report and Vice President Blaylock announced that the Chapter by-laws had been approved by the Council generally in the same form in which they had been submitted. Attendance 26. Attendance ratio 0.34.

• *ATLANTA*: The April meeting of the Atlanta Chapter was presided over by Pres. J. G. Crowley following the social hour and dinner.

W. M. Garrard, chairman of the social committee, reported on plans for the annual dinner dance.

J. A. Marshall, program director, introduced the speaker for the evening, Fritz Schwaemmle, Public Relations Dept., Delta Air Lines, who selected as his topic *Aircraft Cabin Conditioning and Pressurization*. He concluded his talk with a discussion on instrument landing systems. Attendance 32. Attendance ratio 0.29.

• *ATLANTA*: J. A. Marshall introduced the guest speaker, G. C. Robertson, dealer district manager, Carrier Corp., Syracuse, N. Y., who spoke on *Residential Air Conditioning*. This interesting talk included charts and slides and was followed by a lively discussion period.

F. A. Player was presented with a past president's pin. Attendance 58. Attendance ratio 0.51.

*Note: The attendance ratios shown represented the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

• *CENTRAL NEW YORK*: At the March meeting the following were elected to serve for 1953: *President*—C. R. Acheson; *Vice President*—F. D. Putnam; *Treasurer*—L. A. Childs; *Secretary*—H. K. Ormsby, Jr.; *Board of Governors*: F. E. Krell, Lawrence Macrow, and L. J. LaTart.

A resolution, written by D. L. Mills, was presented by A. L. Jones which expressed the sorrow of the Chapter at the loss of its member, O. A. Warren, Syracuse. The members then rose for a minute of silence.

The guest speaker, S. Konzo, research professor of mechanical engineering at the University of Illinois, Urbana, Ill., presented a fast moving discussion on warm air heating and cooling for residential installations. A lively question and answer period followed. Attendance 96.

• *CENTRAL OHIO*: The following were elected to serve for 1953: *President*—N. T. Hess; *Vice President*—J. A. Guy; *Secretary*—R. A. Wilson; *Treasurer*—W. A. Schoonover.

B. W. Cornelius, mechanical engineer, Sims, Cornelius & Schooley, Columbus, Ohio, presented a very interesting speech on the history and new developments of heating systems.

An informative discussion was held on the new Ohio State Building Code. It was decided that the Central Ohio Chapter go on record as opposing the method of administration of this code.

Pres. A. D. Bogen called the April meeting to order at the Fort Hayes Hotel. Attendance 30.

• *CINCINNATI*: Pres. H. E. Russell called the April meeting to order at Engineering Headquarters.

The following committee chairmen were heard from: T. D. Reiley—*membership*; F. J. Bottenhorn, III—*meetings*; C. P. Krantz—*special events*; H. E. Sproull—*legislative*.

The meeting was adjourned and the entire group gathered in the auditorium to hear an address by F. W. Spaulding, head of refrigeration and air conditioning, Proctor & Gamble, Cincinnati, Ohio. Attendance 48.

• *CONNECTICUT*: The election of new officers for 1953 took place at the April meeting, with the following results: *President*—G. F. Nieske; *Vice President*—R. W. Sidbury; *Secretary*—E. J. Hoagland; *Treasurer*—C. L. L'Hommedieu; and *Board of Governors*—T. L. Arnold, E. R. Clement, and Walter Heywood.

F. PAUL ANDERSON AWARD

The Committee of Award for the F. Paul Anderson Medal announces that nominations for the F. Paul Anderson Medal for 1953 are invited. Any member of the Society is eligible for nomination. The award is made in recognition of work done or service performed in the field of heating, ventilating, or air conditioning.

Nominations, together with a full statement of the candidates' qualifications and achievements, should be sent to the Committee at ASHVE Headquarters, 62 Worth St., New York 13, N.Y., prior to August 1, 1953.

F. PAUL ANDERSON COMMITTEE
L. N. Hunter, *Chairman*
M. F. Blankin — L. G. Miller
J. C. Fitts — L. P. Saunders

Pres. T. L. Arnold called the meeting to order at the Towne House, New Haven, and the minutes of the previous meeting were read and approved. The auditing committee and the treasurer presented their reports.

A film on *Exhaust Air Hood Design*, was shown through the courtesy of American Air Filter Co. Attendance 45.

• *GOLDEN GATE*: J. E. Murray, program chairman, introduced the guest speaker, A. L. Buonaccorsi, co-partner, Garthorne, Buonaccorsi & Murray, San Leandro, Calif., who spoke on engineering problems encountered in hospitals. His talk was supplemented with charts and mechanical equipment.

The April meeting was called to order by Pres. T. J. White at the Engineers Club. Several committee chairmen presented their reports. Letters from Reg. F. Taylor, society president and A. V. Hutchinson, executive secretary, regarding the Denver Meeting were read.

A nominating committee with K. F. Baldwin as chairman was appointed. The other members of the committee include James McLachlan, T. C. Douglass, Jr., "Sandy" Sanford and Clyde Wilson-Reid. Attendance 83.

• *INDIANA*: The February meeting, held at the Construction League Building, was a joint meeting of the Indiana Chapter and the Air Conditioning Council of Indianapolis.

Pres. J. T. Hardin opened the meeting by greeting the guests which was followed by three pertinent announcements. He said that Treasurer E. R. Ross had resigned and that Ferdinand Jehle would fill his unexpired term. The March meeting, the president said, would be held jointly with the Air Conditioning Council of Indianapolis and the *American Society of Refrigerating Engineers*, on March 17, at the Construction League Building. An inspection trip to Rose Polytechnic Institute was planned for the April meeting.

J. W. Jackson introduced the guest speaker, the Honorable Alex M. Clark, Mayor of the City of Indianapolis. Mayor Clark spoke on the problems involved in the administration of a city the size of Indianapolis. The specific problems discussed were sanitation, annexation of adjacent and contiguous areas and the dovetailing of governmental functions. The Mayor's general theme was that progress has its price, and the public must be willing to pay for it.

• *INLAND EMPIRE*: Ralph Nelson, Jr. presented a movie, *Industrial Exhaust Ventilation*, produced by the University of Michigan, which proved to be the high spot of the evening.

J. A. Doyle announced that the following had been selected for the 1953-54 term by the nominating committee: *President*—G. M. Dieter; *Vice President*—H. A. Bickel; *Secretary*—F. A. Jenkinson; *Treasurer*—Max Tonn; *Board of Governors*—T. P. Nau, G. C. Murray, and Robert Nevers.

A letter from Reg. F. Taylor, Society president, was read in which he extended his thanks for the hospitality shown to him and Mrs. Taylor while in Spokane.

The April meeting was called to order by Pres. T. P. Nau at the Spokane Hotel. Attendance 22.

• *INLAND EMPIRE*: This was a special meeting assembled at the B.O.F. Lodge, Spokane, in honor of Reg. F. Taylor, president of the Society.

T. P. Nau, president of the Chapter, introduced President Taylor who selected as his topic *Yesterday, Today and Tomorrow*. His stimulating talk not only highlighted the history of the Society, but also consisted of a discussion of the prospects for future development in the field of heating and air conditioning. Attendance 29.

• *IOWA*: S. R. Lewis, Life Member of the Society and well-known Chicago consulting engineer, was the guest speaker. Mr. Lewis related in a most interesting manner his experiences and problems as an engineer in the heating, ventilating and air conditioning field. The questions and discussion which followed indicated a very keen interest in his talk.

D. C. Murphy, chairman of the nominating committee, read the following slate of officers proposed for the new term: *President*—J. F. Sandfort; *Vice President*—W. E. Nanes; *Secretary-Treasurer*—G. J. Kraai; *Board of Governors;* W. A. Schworm, H. A. Schwieger and R. H. Schnell.

The April meeting which was held at the Standards Club in Des Moines was called to order by Pres. R. H. Schnell. Attendance 39.

• *IOWA*: Pres. R. H. Schnell presiding at the March meeting announced that the following members had been appointed to the nominating committee: D. C. Murphy, C. H. McGuiness, C. P. North, Perry La Rue and T. W. Rae.

A letter from Professor Black of Iowa State College was read which expressed his appreciation of the cooperation received from the Chapter at the annual meeting of the *Iowa Engineering Society*. R. S. Stover, permanent delegate, commented that it was a very good meeting with many representatives from Iowa present. M. E. Gould also reported on the coming *I-B-R* and *Warm Air Conferences* to be held at Iowa State College.

The speaker for the evening was M. G. Youngquist, managing director, Coal Heating Service, Inc., whose subject was *Will Coal be Displaced as a Basic Fuel?* followed by a motion picture entitled *Powering America's Progress*. Attendance 36.

• *KANSAS CITY*: G. H. Stoffer, vice president of the Chapter, introduced the guest speaker, J. B. Killebrew, president, Killebrew Engineering Corp., St. Louis, Mo., who spoke on *Heat Exchangers*.

T. R. Wiley reported on his activities in connection with vocational

guidance and stressed the prospects for Chapter participation with other engineering groups in this work. J. E. Miller also commented on the plans for the Spring Party to be held April 11.

Pres. W. A. Reichow called the April meeting to order at the Wishbone Restaurant. Attendance 53.

• *MANITOBA*: Pres. W. J. Atkinson called the March meeting to order at the Fort Garry Hotel.

It was announced that a letter would be sent to D. F. Kenny expressing the members' regrets upon his leaving the Manitoba Chapter and wishing him success in his new venture.

D. B. Brace introduced the speaker for the evening, O. J. Ress, L. J. Mueller Furnace Co., Milwaukee, Wis. Attendance 22. Attendance ratio 0.41.

• *MASSACHUSETTS*: A. L. Hare, vice president of the Chapter, introduced the guest speaker, Prof. S. Konzo, research professor of mechanical engineering, University of Illinois, Urbana, Ill. whose subject was *Trends in Warm Air Heating*. Professor Konzo opened his talk with a discussion on floor temperatures. He said that experiments at the University of Illinois showed that basement temperatures have a marked effect on the temperature variations from floor to ceiling on the first floor. Professor Konzo concluded his talk with some pertinent data on fan operations. All the members agreed that he was one of the most effective speakers the Chapter ever had.

The March meeting was called to order at the Faculty Club of M.I.T., Cambridge. Attendance 60.

• *MICHIGAN*: The April meeting of the Chapter was featured by the Annual Ladies' Night and Past Presidents' Night. Following the dinner, Pres. C. A. Strand introduced seventeen past presidents of the Michigan Chapter who were in attendance.

E. M. Harrigan, Michigan Chapter President, 1923-24, and the oldest living past president, made a few remarks. Past Pres. C. F. Donohoe presented a past president's pin to retiring Pres. G. W. Akers.

Dr. Harvey Merker, Director of Inventory Control and Pharmaceutical Consultant, Parke, Davis and Co., Detroit, presented an interesting talk *Romance of Medicine*. He outlined the history of medicine and the development of drugs during the past one hundred years. He included a discussion of the development of cortisone, atabrine, vitamins, and antibiotics, and potential use of atomic energy in medicine. Dr. Merker was introduced by Meetings Chairman R. J. Oberschulte.

A movie *Destination Mile-High*, which depicted the attractions of Denver and the State of Colorado, preceded the talk and urged attendance at the Semi-Annual Meeting of the Society. Attendance 106.

• *MINNESOTA*: Pres. William Sturm introduced the speaker for the evening, C. W. Nessell, account executive, Minneapolis-Honeywell Regulator Co., Chicago, who gave a very enthusiastic talk on *Warm Air Perimeter Heating Systems*.

The March meeting was called to order at the Coffman Memorial Union at the University of Minnesota. The following committee chairmen presented their reports: J. A. Craig—*financial*; O. L. Lilja—*legislative*, A. R. DeRycke—*entertainment*.

President Sturm read a letter from *CARE* in which they thanked the Minnesota Chapter for the package donated in honor of the late H. E. Gerrish. He also read another letter from the Rocky Mountain Chapter extending an invitation to attend the Semi-Annual Meeting in Denver this summer. Attendance 82.

• *MONTREAL*: The April meeting of the Chapter was highlighted by a talk given by Lewis Smith, C. A. Dunham Co., Ltd., Canada, whose subject was *Modern Methods of Controlling Steam Heating Systems*. Mr. Smith discussed the features of the different kinds of heating systems and the problems involved in controlling them.

Since this was the final meeting of the 1952-53 season called to order by Pres. W. G. Hole, he presented his annual report mentioning his activities of the past year. He then called upon J. G. Chenevert to conduct the installation ceremony for the new president, B. J. Horsburgh. Mr. Horsburgh proposed several committees for the new season. He also suggested that the president, vice president, secretary, and treasurer be appointed as signing officers for the coming year. Attendance 75. Attendance ratio 0.48.

• *NORTH JERSEY*: Prof. S. Konzo, research professor of mechanical engineering, University of Illinois, Urbana, Ill., spoke on *Trends in Warm Air Heating*. This enlightening talk was followed by an interesting discussion period.

H. M. Patrick, chairman of the program committee, reported on the plans for the June social meeting. He also added that the speaker for the April meeting would be O. S. Lieberg who would talk on *High Temperature Water Systems*.

The March meeting was called to order by Pres. F. H. Faust. Attendance 92.

• *NORTH TEXAS*: The April meeting was called to order by J. A. Ray, secretary, in the absence of the president and vice president. H. G. Gregerson served as acting secretary.

R. L. Patton submitted the names of prospective members who will be invited to attend meetings. T. F. Scott, Jr. asked for suggestions on the annual summer meeting. J. L. Tye announced that the May meeting would be held in Fort Worth.

R. C. Knight introduced the speaker for the evening, W. B. Ewing, president of the Ewing Development Co., Bay City, Mich. Mr. Ewing presented a most interesting technical discussion which he supplemented with slides. He also stated that a paper will soon be presented with simplified formulas for solving

a great many shade problems. Attendance 91. Attendance ratio 0.43.

• *NORTH TEXAS*: E. T. Keck, Jr., chairman of the program committee, introduced Luther Bailey, Ford Motor Co., who presented a sound color movie entitled *Car of the Future*. This was followed by a lively question and answer period.

Pres. P. N. Vinther appointed D. C. Pfeiffer and T. H. Anspacher to a technical committee. R. L. Patton, chairman of the membership committee, submitted a plan to increase membership. It was passed with an amendment by a motion from G. A. Linskie.

The March meeting was called to order by Pres. P. N. Vinther at the Melrose Hotel. Attendance 90. Attendance ratio 0.49.

• *NORTHEASTERN OKLAHOMA*: The speaker of the evening was William Bassler, assistant to Society member R. D. Tutt, Tuttle & Bailey, Inc., New Britain, Conn., who spoke in his absence. Mr. Bassler chose as his subject *Modern Trends in Air Distribution*. He covered thoroughly the evolution of air distribution systems with particular emphasis on the forms of present high pressure systems. An active discussion period followed.

C. H. Dollmeyer, chapter representative, reported on the Chapters Conference Committee Meeting.

The March meeting was called to order by Pres. J. N. Watt in the Student Activities Building at the University of Tulsa. Attendance 27. Attendance ratio 0.49.

• *NORTHERN OHIO*: W. G. Jewett, program chairman, introduced the guest speaker, C. G. Andrus who chose as his topic *How's the Humidity?* Mr. Andrus stressed the inherent difficulty of measuring humidity. He stated that, at present, the wet-bulb thermometer was used to measure atmospheric humidity, but that work on newer and more direct methods is constantly carried on. Mr. Andrus also reviewed the effect of humidity on industrial processes. He concluded his talk by stating that it was quite possible to identify the geographical sources of large masses of moist air by identifying their humidity content.

H. M. Nobis, R. L. Byers, and D. L. Taze were elected to the nominating committee. Treas. J. R. Venning reported that the cash balance for the Chapter prior to this meeting was approximately $40.00 more than it was at the last meeting. L. C. Burkes announced that the rosters would be out shortly.

The March meeting was called to order by Pres. R. E. Sherman at the Allerton Hotel. Attendance 56.

• *NORTHERN PIEDMONT*: Dinner and a social hour preceded the business meeting, called to order by Pres. J. E. Hart. The minutes of the February meeting were read and approved and the treasurer submitted his report.

L. B. Hoffman introduced the speaker of the evening, O. F. Lieberg, president of American Caliqua Co., consultant designers, New York, N. Y. Mr. Lieberg spoke on high pressure hot water systems, their characteristics and applications. He also discussed the economics of steam *vs* high temperature hot water systems.

• *ONTARIO*: H. E. Jordan, office of the Ontario Fire Marshall, spoke on *Liquefied Petroleum Gases*. Two movies, *Explosion Danger Lurks* and *Sanitation Safety*, were shown following his talk.

J. H. Fox, chairman of the nominating committee, presented the proposed slate of officers for the new season as follows: *President*—N. W. Kingsland; *Vice President*—M. C. Bailey; *Secretary-Treasurer*—H. R. Roth; *Board of Governors*: D. L. Angus, C. J. Bootes and Charles Torry; *Ex-Officio*—J. H. Ross.

The new members to the Ontario Chapter are Ivan McDonald, Jack Wright and William Mould.

Pres. J. H. Ross called the April meeting to order at the Royal York Hotel. Attendance 83. Attendance ratio 0.35.

• *OREGON*: The Annual Meeting, held on March 20, was called to order at the Mutnomah Hotel, by J. P. McDermott, master of ceremonies for the evening.

S. D. Peterson introduced the guest speaker, J. R. Vernon, Johnson Service Co., Milwaukee, Wis., who gave a very inspiring talk on *Public Relation Possibilities in the Industry*. He stated that good public relations can reverse an actual fact, and that good relations between an employer and an employee can be reduced to the factors of recognition, security and advancement. Mr. Vernon stressed the fact that the prime objectives of any ASHVE Chapter should be to promote the activities of the Society in an effort to secure better public relations and Society recognition.

B. W. Farnes was called upon to install the officers for 1953-54 as follows: — *President*—A. N. Hoss; *Vice President*—E. E. Kelly; *Treasurer*—Dick Blankenship; *Secretary*—J. E. Finkbeiner; *Board of Governors*: K. H. Hanson, G. R. Folds, Jr. and W. B. Hayes.

President Hoss presented a pair of Chapter book ends to Mr. Hanson, retiring president. The final business was the presentation by B. W. Farnes to J. Donald Kroeker of a framed scroll (containing the signatures of Chapter members) in appreciation of Mr. Kroeker's long and able service to the Chapter and the Society. Attendance 130. Attendance ratio 0.40.

• *OTTAWA*: This was a joint meeting of the Ottawa Valley Chapter and the Ottawa Branch of the *Institute of Power Engineers*. The dinner and business meeting was presided over by Pres. Bernard Stotesbury, while the remainder of the program was conducted by the president of *IPE*.

L. J. Greenough, J. D. Partington and R. H. Soderlind, Jr., were selected for the nominating committee.

Guest speaker E. B. Higgins, management consultant and senior partner of E. B. Higgins & Associates, Toronto, chose as his topic *You and*

Your Profession. He presented a brief history of the *Institute of Power Engineers* followed by a discussion of a code of ethics. Mr. Higgins stated that if such a code is followed it would provide social prestige for a society or business organization. Attendance 61.

• *PACIFIC NORTHWEST:* Prof. E. O. Eastwood, past president of the Society and elder statesman of the Chapter, introduced the principal guest speaker, Reg. F. Taylor, Society president. Mr. Taylor discussed the past, present and the future in relation to heating, ventilating and air conditioning. He traced the beginning of the Society's simple experiments with goats in Texas to its present complex research program on Atomic Energy.

C. A. Pickett, Pacific division manager, American Air Filter Co., also gave an interesting talk on school room ventilation.

The March meeting was held at the Stewart Hotel, and called to order by Pres. W. B. Pride. Attendance 61.

• *PHILADELPHIA:* G. S. Hoagland, E.I. DuPont Co., spoke on *The New Synthetic Textile Fibers.* His talk was illustrated with samples of textiles.

C. R. Shaffer was approved as a new member.

The March meeting was called to order by C. F. Dietz at the Engineers Club. Attendance 50.

• *PITTSBURGH:* This meeting was highlighted by an inspection tour of the Mellon-United States Steel Building. Pres. B. B. Reilly presided over a short meeting held in the auditorium of this building.

The nominating committee proposed the following slate of officers for the new term: *President*—C. H. Schneider; *Vice President*—E. C. Hach; *Treasurer*—C. L. Benn; *Secretary*—E. H. Riesmeyer, Jr.; *Board of Governors*: H. B. Grabman and O. L. Williams.

The members of the Pittsburgh Chapter were particularly interested in the Mellon-United States Steel Building as the entire building is scientifically heated and air conditioned. Attendance 88.

• *ROCKY MOUNTAIN:* The speaker for the evening's program was J. W. James, treasurer of ASHVE and vice president in charge of research, McDonnell & Miller, Inc., Chicago, Ill. Mr. James traced the development of hot water heating systems and discussed methods of safety used in present practice.

At the business meeting which preceded the April program, L. L. DeLong, treasurer, gave a financial report, and Pres. N. H. Brickham, presiding officer, appointed the following auditing committee: J. F. Mohan, chairman, F. L. Blush, and William Van Genderen.

The following officers for 1953 were elected at this meeting: *President*—H. L. Wray; *Vice-President*—V. F. Vallero; *Secretary*—J. F. Cipra, Jr.; *Treasurer*—Leo Krisel; and *Board of Governors*—N. H. Brickham, John Bernzen, and K. H. Smith. Attendance 63.

• *ROCKY MOUNTAIN:* The March meeting, which was held at the Albany Hotel, was called to order by Pres. N. H. Brickham. He announced that E. A. Froese spoke on low temperature refrigeration at the last meeting of the *Colorado Engineering Council* and that this meeting broke all attendance records and included 10 Society members among those present.

Fred Janssen, general chairman of the Committee on Arrangements for the Semi-Annual Meeting of the Society in Denver, June 29, 30-July 1, 1953, announced that various committee chairmen and vice chairmen had been appointed. He also said that inquiries concerning the meeting and accommodations had already been received. Assisting Mr. Janssen on the Committee on Arrangements are *Vice Chairman*—E. A. Thompson and *Honorary Chairman*—Prof. B. H. Spurlock, Jr.

A. S. Widdowfield introduced the speaker of the evening, W. W. Kennedy, chief engineer, Air Distribution Development of the Barber-Colman Co., Rockford, Ill., who spoke on high velocity air distribution. This timely subject was made especially interesting by Mr. Kennedy's extended background in the field of air distribution. Attendance 65.

• *ST. LOUIS:* H. W. Alyea, development and field engineer, Johnson Service Co., Milwaukee, Wis., speaker at the March meeting, chose as his topic *Modern Trends in Automatic Controls.* Mr. Alyea reviewed the basic principles of air behavior in duct systems. By the use of slides, he showed how differences in position of dampers affect the pressure in the system where variable volume control is required. Mr. Alyea also described the latest methods of controlling unit ventilators.

W. A. Russell, reporting for the Committee on Joint Council of Engineering Societies of St. Louis, stated that at the suggestion of the Chapter's representatives on the Council, the constitution and bylaws of this Council had been revised to eliminate certain sections which made the group liable for taxation.

A nominating committee to select officers for the new term was named as follows: J. S. Rosebrough, E. E. Carlson, G. W. F. Myers, J. B. Killebrew and B. C. Simons. Attendance 18.

• *ST. LOUIS:* The February dinner meeting was held in conjunction with the St. Louis Section of the *ASRE* at the Gatesworth Hotel. After dinner, the group went to the Engineers Club for a joint meeting of the three groups.

H. C. Sharp, vice president of the St. Louis Chapter, introduced the guest speaker, I. W. Cotton, member of the 1953 Committee on Research and president of the I. W. Cotton Co., Indianapolis. Mr. Cotton gave a very interesting discussion of the progress in research carried on by the Society. He traced the history of research in ASHVE from its be-

ginning to the present time, and elaborated on the various projects conducted by the Society, the most recent being a research project on odor.

• *SHREVEPORT:* Pres. W. S. Evans called the March meeting to order at the Louisiana School of Technology.

The guest speaker was A. B. Newton, vice president in charge of engineering, Acme Industries, Jackson, Mich., who spoke on *Residential Air Conditioning.* The talk was followed by a lively question and answer period. Attendance 19. Attendance ratio 0.35.

• *SOUTH TEXAS:* W. L. Lashley, Jr. introduced the guest speaker A. B. Newton, vice president of engineering, Acme Industries, Inc., Jackson, Mich., who spoke on residential air conditioning, the heat pump, etc. He listed the reasons for air conditioning as comfort, health, cleanliness, less noise and absence of storm worries. Mr. Newton also stated that the *National Warm Air Heating and Air Conditioning Association* is soon to have a new method for calculating residential cooling loads.

J. W. Holland, who was Chapter representative to the Annual Meeting held in Chicago, reported on the Chapters Conference Committee Meeting. D. M. Mills also reported on the status of appointments of committees for the Annual Meeting to be held in Houston in 1954.

The March meeting was called to order by Pres. C. L. Fleming. Attendance 95. Attendance ratio 0.42.

• *SOUTHERN CALIFORNIA:* The March dinner meeting was held at the Carolina Pines Restaurant, and a film entitled *Industrial Exhaust Ventilation*, prepared by the University of Michigan, was shown in place of the usual coffee talk.

The speaker of the evening was Reg. F. Taylor, President of the ASHVE and consulting engineer of Houston, Tex., who spoke on *Yesterday — Today and Tomorrow.* President Taylor traced the growth of the Society from its small beginning of 75 members to its present membership of approximately 8500. He also described the Society's present research program and outlined the functions of the Technical Advisory Committees. Attendance 87.

• *SOUTHERN CALIFORNIA:* The feature of the evening was an address by A. J. Hess, president, Hess-Greiner & Polland, Los Angeles, Calif., who spoke on *High Temperature Hot Water Heating Systems.* Mr. Hess' interesting subject drew the largest attendance of the year.

The April meeting was called to order by Pres. J. S. Earhart, and the nominating committee presented its slate of nominees for 1953 officers. L. B. Davenport presented movies taken at the Annual Meeting in Chicago, which were enjoyed by all. Attendance 127.

• *SOUTHWEST TEXAS:* Pres. D. E. Locher called the April meeting to order and the minutes of the March meeting were accepted. A letter of invitation to the membership to attend the Conference on Year 'Round Residential Air Conditioning at Lehigh University was read by the secretary.

The speaker of the evening, R. A. Thompson, assistant manager of the San Antonio Water Board, spoke on *Underground Waters.* Part of Mr. Thompson's talk was devoted to a discussion on the history of San Antonio's water supply — past, present and future, in which he quoted numerous figures.

Mr. Thompson indicated a number of new water sources, some of which were surface waters, but most of which were additional underground sources to be tapped. He stated that of the average 30 in. of rain which falls on the United States only 1 in. is used, 8 in. comprises our run-off, while the balance, 21 in., either evaporates or soaks into the ground. He added that underground waters are not storage reservoirs but moving streams and that which is not reclaimed, like river water, is lost forever.

An interesting discussion period followed Mr. Thompson's talk. Attendance 25. Attendance ratio 0.29.

• *VIRGINIA:* The speaker of the evening was Roy Horton, Service Information Division of the White Rodgers Electric Co., who spoke on *Service and Application of Automatic Controls.*

At the April business meeting the minutes of the March meeting were read and approved, and M. H. Pelosi, program chairman, made a preliminary report on programs for future meetings, stating that a full report would be given at the May meeting.

Pres. E. D. Duval, presiding officer, announced that the membership had been invited to attend a Conference on Year 'Round Residential Air Conditioning at Lehigh University, to be sponsored by the ASHVE in conjunction with a number of other organizations. Attendance 16. Attendance ratio 0.32.

• *WASHINGTON, D.C.:* The following were elected to serve for 1953: *President* — J. G. Muirheid; *Vice President* — G. C. F. Asker; *Treasurer* — J. W. Alexander; *Secretary* — W. C. Reamy, Jr., *Chapter representative* — J. G. Muirheid; *Alternate* — P. R. Achenbach; *Board of Governors*: G. R. Walz, J. J. Nolan, Jr. and J. C. Benson.

An announcement was made that Ladies Night would be held in conjunction with the Engineers Club of Washington, May 15, 1953, at the Congressional Country Club.

Pres. G. R. Walz introduced the guest speaker, S. Konzo, research professor of mechanical engineering at the University of Illinois, Urbana, Ill., who spoke on *Trends in Warm Air Heating.* Professor Konzo first discussed normal conditions of floor slabs on the ground. Then he elaborated on panel heating in floors, baseboard heating, ceiling panel heating, etc. Finally, the professor stressed perimeter ducts with registers in the floor under the windows or low in the side walls. President Walz called this March meeting to order. Attendance 76. Attendance ratio 0.49.

• *WASHINGTON, D.C.:* The February meeting was called to order by Pres. G. R. Walz at Naylor's Sea Food Restaurant.

G. W. Campbell introduced the speaker of the evening, E. F. Gill, industrial advisor, Technical Cooperation Administration, State Department. Mr. Gill discussed the workings of the Point Four Program. He stated that its purpose is to assist foreign countries in their efforts to help themselves industrially and economically, but not, as generally believed, to provide large sums of money for the purpose. Mr. Gill stressed the fact that the industries of foreign countries could be developed with proper handling and capital. Attendance 25.

• *WESTERN MICHIGAN:* The feature of the April meeting of the Chapter was a talk by D. E. Herringshaw, vice president, Consumer's Power Co., who spoke on *Gas Storage and Disposition in Michigan*. His informative talk was followed by a colored film entitled *Natural Gas Pioneer*.

The meeting was preceded by dinner and presided over by Pres. H. R. Limbacher. The chairman of the nominating committee, C. H. Pesterfield, presented the nominees for Chapter officers for the coming year. Attendance 63. Attendance ratio 0.26.

• *WESTERN NEW YORK:* The Chapter held a joint April meeting with the Central New York Chapter at the University Club in Rochester. C. W. Stone, Buffalo, served as joint meeting chairman, and welcomed the guests and introduced the Rochester members of the Society who had aided in planning the meeting and program.

The highlight of the evening was a panel discussion on *Air Conditioning of Industrial Plants* moderated by R. E. Cherne. The panel members were H. A. Mosher, Eastman-Kodak Co.; Arthur Mathias, plant engineer, Gleason Works; Ignatio Molinet, chief engineer, Carrier Corp.; P. D. Robson, a consulting engineer, Syracuse, N. Y.

At the business meeting which was preceded by a tour of the Rochester Products Division of the General Motors Corp., Pres. J. M. Quackenbush announced the nominees for Chapter officers for the coming year.

Pres. F. E. Krell of the Central New York Chapter was introduced and presented the officers of his Chapter who attended the meeting. Attendance 121. Attendance ratio 0.58.

• *WESTERN NEW YORK:* Pres. J. M. Quackenbush called the March meeting to order at the University Club.

Harold Eskin, engineering department, Westinghouse Electric Corp., spoke on *Selection and Maintenance of Electric Motors*. A short film entitled *Maintenance Ain't No Problem* preceded his talk.

C. W. Stone gave a brief outline of the Industrial Conference held April 22, and mentioned that the Society was represented on one panel by M. C. Beman, J. E. Gill and Q. P. Thompson. Attendance 50. Attendance ratio 0.68.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 101 applications for membership, including 4 student applications and 3 reinstatements, in addition 6 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by June 29, 1953, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement.

California

BIVENS, J. J., Instructor, Air Conditioning Service, Southern California Gas Co., Los Angeles. REFERENCES: L. J. Kemp*, F. G. Little, A. F. Michael, L. B. Rayl.

HIRT, R. E., Service Engr., The Ric-wil Co., San Francisco. REFERENCES: E. H. Goins, C. Gottwald, Salvatore Traina, C. W. Wheeler.

MACOMBER, J. B., Engr., American Air Filter Co., Inc., Los Angeles. REFERENCES: W. L. Donley, F. M. Neal, R. C. Taylor, R. W. Thomas

OLIVER, E. J., Engr., The Ric-wil Co., San Francisco. REFERENCES: E. H. Goins, C. Gottwald, Salvatore Traina, C. W. Wheeler.

SMITH, H. D., Promotional Sales Repr., Crane Co., Los Angeles. REFERENCES: J. R. Bishop, Paul Bradfield*, J. L. McCullough, G. E. Randall.

△SMITH, J. B., Asst. Mgr., Johnson Service Co., San Francisco. REFERENCES: Charles Lambert, J. E. Murray, N. H. Peterson, T. J. White.

WILKERSON, R. B., Engr., Johnson Service Co., Los Angeles. REFERENCES: L. B. Davenport, A. J. Hess, J. R. Vernon, C. D. Walz.

JOURNAL SECTION

Colorado

BINNING, G. H., Engr., The Trane Co., Denver. REFERENCES: N. H. Brickham, H. D. Gregory, A. S. Widdowfield, J. R. Wilson.

DOWDLE, W. R., Pres.-Treas., Dowdle Air Conditioning & Heating Co., Denver. REFERENCES: Warner Burbank, J. P. Dresen*, Fred Janssen, J. H. McCabe.

FOX, S. E., Partner, Sam Fox Sheet Metal Co., Denver. REFERENCES: H. H. Herman, J. H. McCabe, E. J. McEahern, A. S. Widdowfield.

OLSON, W. A., Pres., Olson Bros. Inc., Denver. REFERENCES: N. H. Brickham, J. H. McCabe, L. D. Niblack, A. S. Widdowfield.

PETTIGREW, F. R., Chief Draftsman, McCarty, Johnson, Davis & Bell, Denver. REFERENCES: J. F. Cipra, Jr., J. F. Salsburg, J. D. Willoughby, H. L. Wray.

Connecticut

AGARD, H. B., Engr., M. Seligman & Sons, Meriden. REFERENCES: T. L. Arnold, E. R. Clement, P. J. Lamoureux, C. J. Wahnquist, Jr.

HAMEL, L. J., Draftsman, Paul D. Bemis, Cons. Engr., Hartford. REFERENCES: P. D. Bemis, R. W. Briggs, L. O. R. Clark, C. W. Freeman.

Florida

†DENSON, WALTER, JR., Engr., Walter Denson & Son, Jacksonville. REFERENCES: A. E. Celler*, N. C. Lee*, W. R. Stults*, W. L. Tribble*.

Georgia

△BORUM, J. W., Cons. Engr., Lazenby & Borum, Atlanta. REFERENCES: J. G. Croley, J. S. Edgar, J. M. Lazenby, W. J. McKinney.

SCOTT, J. F., Engr., Southern Bell Telephone & Telegraph Co., Atlanta. REFERENCES: J. W. Borum, S. W. Boyd, J. M. Lazenby, H. K. McCain.

Illinois

ARMSTRONG, H. J., Repr., W. C. Morse, Chicago. REFERENCES: G. W. Bornquist, R. T. Flickinger, C. O. Pratt, N. W. Swanson.

ARNOLD, J. M., Pres., Geo. A. Henrich Co., Chicago. REFERENCES: G. W. Bornquist, C. E. Crone, J. S. Kearney, E. R. Teske.

CARLSON, G. F., Valve Engr., Bell & Gossett Co., Morton Grove. REFERENCES: E. J. Gossett, H. B. Johns, H. A. Lockhart, L. S. Oosten.

ERICKSON, L. A., Mech. Engr., The Austin Co., Chicago. REFERENCES: M. W. Bishop, H. E. Litwack, H. G. Swart, G. V. Zintel.

FITCH, O. A., Associate Engr., Crane Co., Chicago. REFERENCES: F. D. Cotterman, R. L. Ford, E. M. Peterson, C. E. Towner.

LAWRIE, W. J., Engr., O. A. Wendt Co., Chicago. REFERENCES: M. W. Bishop, C. A. Imming, E. H. Wendt, G. V. Zintel.

MCKEEGAN, J. E., Engr., Fred W. Kramer and Assocs., Chicago. REFERENCES: A. M. Bladen, J. H. Clarke, J. S. Kearney, P. J. Marschall.

PECIS, J. G., Associate Engr., Crane Co., Chicago. REFERENCES: R. L. Ford, William Goodman, M. W. McRae, E. M. Peterson.

REED, K. E., Engr., Marsh & McLennan, Inc., Chicago. REFERENCES: F. A. Faville*, Earl Harrington*, A. A. Morey, L. H. Rowe*.

Indiana

KELLEY, W. R., Vice Pres., Eddy Isbey, Inc., Michigan City. REFERENCES: Eddy Isbey*, Merle Miller*, David Ross*, R. J. Tenkonohy.

Kentucky

ZANONE, E. G., Engr., Clayton & Lambert Mfg. Co., Louisville. REFERENCES: N. B. Buehrer, D. M. Mills, J. J. Tyson*, H. A. Zanone.

Louisiana

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ERICHSON, F. M., Associate, H. J. Kelly, New Orleans. REFERENCES: Ralph Elizardi, L. V. Cressy, T. A. Stokes, H. J. Kelly.

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Massachusetts

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Mississippi

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Missouri

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New Jersey

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Ohio

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Oregon

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Rhode Island

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Tennessee

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Texas

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Washington

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Canada

ARMITAGE, F. L., Mgr., Htg. Dept., Crane Ltd., Montreal. REFERENCES: G. L. Ballantyne, T. E. Cockman, J. B. Flanagan, J. A. Sullivan.

BARBER, E. H. J., Tech. Officer, Dept. of Veterans Affairs, Canadian Govt., Ottawa. REFERENCES: Charles Harrington*, E. J. Schoenherr, Charles Southgate*, G. W. Wilson*.

BAXTER, D. W., Vice Pres., W. E. Baxter Ltd., Montreal. REFERENCES: R. R. Duquette, W. G. Hole, W. E. Jarvis, D. L. Lindsay.

BRISSETTE, J. L., Owner, Canada Radiation & Convection, Montreal. REFERENCES: S. S. Colle, J. P. Keith, Guy Montpetit, P. P. Vinet.

HOCKIN, J. M., Mgr., Architectural Glass Sales, Hobbs Glass Ltd., Toronto. REFERENCES: W. T. E. Duncan, W. H. Evans, J. H. Fox, W. H. Polk*.

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MICK, Gerald, Dir., W. E. Baxter Ltd., Montreal. REFERENCES: J. C. Hennesey,

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Argentina

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England

HOLMES, M. J., Design Draftsman, British Railways, Southern Region, London. REFERENCES: L. Burt*, F. C. Foreman*, J. Smythe*, J. H. Van Eusom*.

France

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Students

IOWA STATE COLLEGE,
Ames, Ia. CERTIFIED BY: J. F. Sandfort. DAVIS, R. H., ROGERS, D. A., SHAH, A. M.

OREGON STATE COLLEGE,
Corvallis, Ore. CERTIFIED BY: A. D. Hughes. SHARP, R. F.

PAST PRESIDENT'S CLUB OF ILLINOIS CHAPTER

The Past President's Club of the Illinois Chapter met for dinner Monday, April 27, at the Merchandise Mart, Chicago. Sixteen of the 30 living past presidents of the chapter attended the affair, with J. S. Locke coming from Minneapolis and J. R. Vernon from Milwaukee. Greetings from many other past presidents who could not attend were read.

S. R. Lewis is president of the Past Presidents' Club. P. J. Marschall is vice president, and M. W. Bishop, who has just completed his term of office as the Illinois Chapter's president, is secretary of the Past Presidents' Club.

The other past presidents who attended are as follows: E. P. Heckel, S. I. Rottmayer, C. W. DeLand, C. M. Burnam, Jr., J. J. Aeberly, J. H. Milliken, A. O. May, W. A. Kuechenberg, C. E. Price, G. W. Bornquist, and J. S. Kearney.

The Illinois Chapter is the oldest and one of the most active in the Society. It is believed also to be the first chapter to have a Past Presidents' Club. Although the objective of the club is social, the group is ready at any time to be of whatever help it can be to the chapter.

MEETING OF ASHVE TAC ON PHYSIOLOGICAL RESEARCH

The Technical Advisory Committee on Physiological Research of the ASHVE held an informal dinner meeting in conjunction with the *American Society of Biological Chemists*, April 6, 1953, at the Conrad Hilton Hotel, Chicago, Ill.

The meeting was devoted to the presentation and discussion of topics which are of importance to heating, ventilating and air conditioning engineers, as well as doctors, physiologists and the armed forces. Dr. E. F. DuBois, M.D., professor emeritus of physiology, Cornell University, New York, served as chairman.

M. K. Fahnestock, research professor of mechanical engineering, University of Illinois, Urbana, Ill., opened the meeting with a discussion on radiation in commonplace environments; such as in the home, office, school, etc. Professor Fahnestock also stressed the need for objective measurements and the correlation of these measurements with human response. Alice M. Stoll, Department of Physiology, Cornell University Medical College and Russell Sage Institute of Pathology, New York, N. Y., supplemented Professor Fahnestock's discussion with a talk on a new radiometer and prevailing conditions in Alaska; while Dr. T. H. Benzinger, Naval Medical Research Institute, Bethesda, Md., spoke on human calorimetry, instrumentation and techniques.

Low Humidity was the second topic on the agenda and Dr. C. R. Spealman, chief, safety products branch, Medical Division, Civil Aeronautics Administration, Washington, D. C., commenced with a talk on occurrence, measurement and effect on human health and comfort. The other speakers contributing to this topic were as follows: Dr. F. K. Hick, M.D., professor of medicine, University of Illinois — *Physiologic Adjustments of Impaired, Lean and Obese Persons to Rapid Changes in Environment* and *Thermal Requirements of Aged and Sub-Normal Persons;* Dr. H. F. Dowling, M.D., professor of medicine and head of department, University of Illinois College of Medicine — *Relation of the Common Cold to Temperature and Humidity*. The meeting terminated with a discussion on *Environmental Problems of the Armed Forces with Special Reference to Needed Studies*. Dr. D. E. Copeland, M.D., chief, physiological training branch, Aviation Medicine Division, Washington, D. C., spoke on the *Air Force*. Capt. T. L. Willmon, executive officer, Naval Medical Research Institute, Bethesda, Md., gave a talk on the *Navy*. Both Col. R. L. Callison, M.C., Preventive Medicine Div., Office of the Surgeon General, Washington, D. C., and Lt. Col. C. F. Tessmer, M.C., Army Research Laboratory, Fort Knox, Ky., selected the *Army* as their topic.

P. K. ADDAMS ELECTED PRESIDENT *OHI*

Paul K. Addams, president, Fitzgibbons Boiler Co., Inc., New York, N.Y., was elected president of the *Oil-Heat Institute of America*, April 22, 1953, at the 31st Annual Convention in Chicago. A member of the Society since 1943, he is the son of Dr. Homer K. Addams, ASHVE Charter and Life Member.

Mr. Addams served the Institute for many years on various committees. As a director of the accessory division, he held terms as secretary, vice chairman and then chairman from which he moved to the vice presidency of the Institute in 1952. As a member of the Institute, he worked in close association with the petroleum industry.

In 1929, after graduation from the Wharton School of Finance and Commerce, University of Pennsylvania, he came to the Fitzgibbons Boiler Co., Inc. He succeeded his father as president of this company in 1947.

P. K. Addams

Mr. Addams belongs to the Engineers Club, Union League Club and the University of Pennsylvania Club of New York.

L. T. MART PRESIDENT *CTI*

L. T. Mart, president of The Marley Co., Kansas City, Mo., was elected president of the *Cooling Tower Institute* at the recent annual meeting of the group in San Francisco. Other officers elected for the 1953 season were: N. B. LauBach, Hudson Engineering Corp., Houston, vice president; P. R. Hoffmann, Lilie-Hoffmann Cooling Towers, St. Louis, secretary; C. E. Pickup, The Fluor Corp., Los Angeles, treas-

L. T. Mart

urer. Executive offices of the Institute at Palo Alto, Calif., will continue under the direction of R. C. Kelly, executive manager.

Expanded programs of technical field studies were approved by the Board of Directors at the San Francisco meeting. In cooperation with the California Redwood Association, the U. S. Forest Products Laboratory and the Institute of Paper Chemistry, the Institute this year will complete some of its comprehensive field studies for the improvement of water conservation equipment.

Mr. Kelly stated that this new research work is in a branch of technology which has been inadequately treated in the engineering field in past years. Twenty selected cooling tower users are contributing their plant facilities for the Institute studies. Field work is under the supervision of the *Cooling Tower Institute* field engineer J. L. Willa, based at Houston, Texas.

Personals

Advancement of H. P. Mueller, Jr., and F. J. Nunlist, Jr., to vice presidents of the L. J. Mueller Co., Milwaukee, was recently announced by

H. P. Mueller, Jr.

H. P. Mueller, Sr., President. H. P. Mueller, Jr., was formerly assistant sales manager; F. J. Nunlist, Jr., was formerly general sales manager. H. D. Wirth, former controller, was named secretary of the Company.

Mr. Mueller who joined the Society in 1949, has had a diversified background in the Company, starting in the engineering department, then serving as a sales representative in the Milwaukee area.

Mr. Nunlist is a past president of the ASHVE Chapter in Milwaukee and is currently serving as a member of the Society's Guide Committee. He is well known in the heating industry, at present serving as a director of the *National Warm Air Heating and Air Conditioning Association*, and chairman of the Central Heating Requirements Committee of the *Gas Appliance Manufacturers' Association*.

F. J. Nunlist, Jr.

E. A. Norman, Jr.

E. A. Norman, Jr., president of Norman Products Co., Columbus, Ohio, and a member of the Society since 1944, recently announced that his firm had purchased all production machinery and tools of the Security Manufacturing Co., of Kansas City.

With this expansion, Norman Products Co. will enter the manufacture of gas-fired heating units and air conditioning equipment.

R. M. Johnson

The appointment of R. M. Johnson as Southern California Manager for General Controls Co., Glendale, Calif., has been announced by F. J. Fay, vice president in charge of sales.

Mr. Johnson, a member of ASHVE, is a registered professional engineer, and past chairman of the floor furnace group of the *Gas Appliance Manufacturers' Association*.

Mr. Johnson, a native of Los Angeles and a U.C.L.A. graduate, has had more than 15 years experience in the heating, ventilating and air conditioning fields. He was formerly with the Payne Furnace Division of Affiliated Gas Equipment, Inc., where he was assistant sales manager.

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Headquarters: 62 Worth St., New York 13, N. Y. **Research Laboratory:** 7218 Euclid Ave., Cleveland 3, Ohio

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OBITUARIES

CLARENCE F. KESSLER
Ann Arbor, Mich.

The Society learned with sorrow that Clarence F. Kessler, associate professor of mechanical engineering, the University of Michigan, Ann Arbor, had passed away some time during the month of March. Professor Kessler joined the Society in 1938.

Born in Sandusky, Ohio, Professor Kessler attended the University of Michigan, graduating in 1919 with a B.S. in mechanical engineering; in 1924 he received his M.S. in mechanical engineering from the University.

He joined the staff of the University of Michigan in 1920 as an instructor in mechanical engineering. In 1926 he was made assistant professor and at the time of his death he was associate professor of mechanical engineering. Professor Kessler's courses included heat engines, thermodynamics and heating and ventilating.

DAVID E. McCULLEY
Omaha, Nebr.

Word of the death on March 27, 1953 of David E. McCulley has been received by the Society. Mr. McCulley had been a member of the Society for a period of approximately 25 years.

Born in Missouri on May 16, 1877, Mr. McCulley attended college in Tarkio, Mo., and later moved to Omaha where he became a licensed professional engineer. A manufacturer's agent dealing chiefly in heating equipment, he represented such firms as Young Radiator Co., Pacific Boiler Corp., Clarage Fan Co., Anemostat Corp. of America, and Fulton Sylphon Co. In June of last year Mr. McCulley moved his heating equipment firm to new quarters, and his associates are presently conducting the business and are planning to continue along the same lines set up by Mr. McCulley.

He was also a member of the *Oil Heat Institute*, the *National Association of Professional Engineers*, the Omaha Engineer's Club, the Masons, Capitol Lodge, #3 Blue Lodge, the Scottish Rite in Omaha, and an active member of Rotary International.

The Officers and Council of the Society extend their deep sympathy to his widow, Mrs. Ethel S. McCulley, a son, William, and a daughter, Mrs. G. E. McFarland, Jr.

RONALD W. ROGERS
Winnipeg, Man., Canada

News has been received of the sudden passing of Ronald W. Rogers in his home on March 20. Mr. Rogers was accepted into the Society in January 1952 as a junior member.

Born on June 23, 1926, at Deveron, Saskatoon, Canada, he attended Wimbledon Tech in England, and from 1942-44 was a draftsman and sales engineer with Sturterest Engineering Co., London. Mr. Rogers joined the British Army in 1944 serving until 1948. Between 1949 and 1951 Mr. Rogers was associated with the Clare Brothers Western Co., Ltd., and the Acme Fan and Blower Co. Mr. Rogers was manager of the Warm Air Heating Department of J. H. Ashdown Hardware at the time of his death.

OLIN A. WARREN
Syracuse, N.Y.

Olin A. Warren, member of the Society since 1946, died in his home on March 10.

Mr. Warren was born at Fine, N. Y., on October 28, 1895, and attended Syracuse University, graduating with an M.E. degree in 1920. During his career, Mr. Warren engaged in various kinds of work including design and drafting of heating and ventilating systems and power plants, and supervision of construction for a general contracting firm. He also supervised the mechanical inspection of a major construction job for Stone and Webster, Inc. At the time of his death he was a consulting mechanical engineer for Robson & Woese, Inc., Syracuse.

Mr. Warren, a registered professional engineer in the State of New York, was a member of Tau Beta Pi, Phi Kappa Phi and Sigma Nu fraternities, the Technology Club, and the *Professional Engineering Society*.

Surviving are his wife, Mrs. Esther Wilson Warren, a son, Roger Warren, recently reported missing in action on the Korean front, and a daughter, Mrs. H. P. Citek.

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(53 Chapters—1 Special Branch—9 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

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● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, E. H. Kent, 2322 N. Charles St. (18). SECRETARY, A. M. Kroft, 401 Tower Building (2).

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. PRESIDENT, M. E. Minaker, 1128 Burrard St. SECRETARY, D. W. Thomson, 445 Richards St.

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, C. R. Acheson, 306 W. Genesee St. SECRETARY, H. K. Ormsby, 205 S. Townsend St. (2).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, N. T. Hess, 63 E. Goodale St. SECRETARY, R. A. Wilson, 20 S. Third St., (15).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, H. E. Russell, 4th & Main Sts., Box 960. SECRETARY, F. W. Wilson, 222-24 E. 14th St.

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, G. F. Nieske, 165 Maple St., Naugatuck. SECRETARY, E. J. Hoagland, 257 S. Whitney St., Hartford.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, Walter Cooke, 816 Howard Ave. (13). SECRETARY, T. J. Jenny, 1000 S. Peters St. (9).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. PRESIDENT, N. W. Burrill, 33 Riverside Ave., Rensselaer. SECRETARY, L. V. Appleby, R.D. 2, Watervliet.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, T. J. White, 625 Market St. (5). SECRETARY, Eric Roberts, 417 Market St. (5).

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, M. W. Bishop, Rm. 1504, 228 N. LaSalle St. (1). SECRETARY, G. V. Zintel, 1217 W. Washington Blvd. (7).

● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, J. T. Hardin, 720 Noble St. (2). SECRETARY, P. O. Patterson, 2701 Roosevelt Ave., (18).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, T. P. Nau, S. 1419 Walnut (9). SECRETARY, H. A. Bickel, E. 7 Riverside Ave.

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, R. H. Schnell, 4119 Northwest Dr. (10). SECRETARY, Bowen Campbell, 1435 Casady Dr. (5).

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tuesday after First Monday. PRESIDENT, O. P. Bullock, 254 Laura (7). SECRETARY, H. D. Speyer, 120 Ida.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, W. A. Reichow, 1621 E. 31st St. (3). SECRETARY, J. G. Barnes, Jr., 1924 Oak St.

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, W. J. Atkinson, 812 Boyd Bldg. SECRETARY, Ernest Lambert, 93 Lombard St.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, G. B. Torrens, 15 Alden Lane, Shrewsbury. SECRETARY, G. D. Fife, Rm. 606, 79 Milk St. (9).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Drake, 15 N. Reese. SECRETARY, A. T. Bevil, 1638 Union Ave. (4).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, John Schweiger, 593 Acorn Drive, Dayton (9). SECRETARY, D. E. Tullis, 743 Kiser St. (4).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, C. A. Strand, 9117 Hamilton Ave. (2). SECRETARY, D. S. Falk, 4864 Woodward Ave. (1).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, E. T. Erickson, 500 Baker Arcade. SECRETARY, V. E. Pearson, 739 Marquette Ave. (2).

● **MISSISSIPPI:** 1953. Hdqrs., Jackson, Miss. PRESIDENT, Burt Lomax, Jr., P. O. Box 1662. SECRETARY, J. G. Coleman, 2840 Arbor Hills Drive.

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, B. J. Horsburgh, 940 Ogilvy Ave. (15). SECRETARY, R. J. Ker, 1000 Beaver Hall Hill, P. O. Box 340.

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, S. W. Black, 18th & Harney Sts. SECRETARY, H. H. Ulrich, 608 City Hall (2).

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, P. B. Gordon, 222 E. 41st St. (17). SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, Second Tuesday. PRESIDENT, F. H. Faust, 5 Lawrence St., Bloomfield. SECRETARY, C. H. Smith, 2490 Vreeland Mills Rd., Linden.

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, P. N. Vinther, 929 Mercantile Securities Bldg. SECRETARY, J. A. Ray, 4411 Belmont Ave. (4).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, J. N. Watt, 528 E. Fifth. SECRETARY, J. C. Netherton, Jr., 3130 E. 44th St.

● **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, Second Monday. PRESIDENT, R. E. Sherman, 570 Hanna Bldg. (15). SECRETARY, R. G. Huebscher, 7218 Euclid Ave. (3).

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N.C. PRESIDENT, J. E. Hart, 1001 E. Bessemer Ave. SECRETARY, S. T. Oliver, 2307 Fairfield Ave.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, W. J. Collins, Jr., 1708 Westminster Pl. SECRETARY, F. X. Loeffler, Jr., 1604 N. W. Fifth St.

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, N. W. Kingsland, 31 Willcocks St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, A. N. Hoss, 621 S.W. Alder (5). SECRETARY, J. E. Finkbeiner, 10260 S.W. Daphne Pl. (1).

● **OTTAWA VALLEY:** 1952. Hdqrs., Ottawa, Ont., Canada. PRESIDENT, Bernard Stotesbury, 955 Somerset St. W. SECRETARY, E. J. Schoenherr, 32 Clarey Ave. (1).

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, W. B. Pride, 3111 Dose Ter. (44). SECRETARY, I. L. Winsor, P.O. Box 7077, Riverton Hgts. Br. (88).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, M. E. Barnard, 12 S. 12th St. (7). SECRETARY, C. J. Lubking, 5060 Wayne Ave.

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, B. B. Reilly, Fifth & Liberty Aves. (22). SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, L. H. Wray, 1101 Geneva St., Aurora. SECRETARY, J. F. Cipra, Jr., 2676 S. Madison St.

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. PRESIDENT, L. A. O'Meara, 1400 Tenth St. SECRETARY, J. E. Marshall, 441 Pico Way (19).

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, C. H. Burnap, 235 Keruish Pl., Webster Groves (19). SECRETARY, J. F. Naylor, Jr., 2335 S. Grand Ave. (4).

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, W. S. Evans, 614 Johnson Bldg. SECRETARY, J. S. Malahy, Jr., 1839 Line Ave.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, C. L. Fleming, 809 M. & M. Bldg. SECRETARY, J. W. Holland, 245 Esperson Bldg. (2).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, J. S. Earhart, 2734 Fleur Dr., San Marino (9). SECRETARY, C. D. Walz, 3600 San Pasqual St., Pasadena (10).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRESIDENT, R. E. Mason, 1726 Hutchinson Ave. (1). SECRETARY, S. B. Blanton, Box 6096.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, D. E. Locher, Box 949, Corpus Christi. SECRETARY, F. B. Frazee, 1013 Riverside Dr., Austin.

● **UTAH: 1944.** Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, D. R. Wilde, 2634 S. 19th E. (1). SECRETARY, Alfred Richeda, P.O. Box 479 (9).

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, E. D. Duval, 1023 Hanover Ave. SECRETARY, T. B. Carpenter, 412 Chester St.

● **WASHINGTON, D. C.** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, J. G. Muirheid, Bureau of Ships, Navy Dept. (25). SECRETARY, W. C. Reamy, Jr., 17th & Pennsylvania Ave., N. W. (6).

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, H. R. Limbacher, 760 E. Vine St., Kalamazoo. SECRETARY, F. K. Platt, P.O. Box 307, Kalamazoo.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, C. W. Stone, 503 Franklin St. (2). SECRETARY, C. W. Kaupp, 271 Delaware Ave.

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, J. A. Lotte, 2505 N. 97th St., Wauwatosa (10). SECRETARY, I. J. Rossiter, 231 W. Wisconsin (3).

SPECIAL BRANCH

● **SWISS:** 1952. Hdqrs., Zurich, Switzerland. PRESIDENT, Leo de Bruyn, Muhlebachstr, 172, Zurich. SECRETARY, Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, 5-B Vetville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 3332, College Station.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. Address mail to: Prof. R. R. Irwin, Dept. of M. E., Oklahoma A. & M. College.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. E. Bulletset, 252 Kings Rd. SECRETARY, I. P. Parkhurst, 1354 Harrison.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

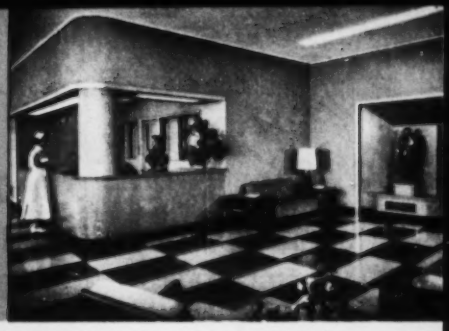
● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, C. E. Beavers, Box 4083. SECRETARY, C. R. Blank, Jr., Box 2021.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, T. J. Feahney, Jr., 18263 Oak Dr. (21). SECRETARY, W. F. Thull, 18313 New Jersey (19).

● **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, H. M. Braymer, 1307-C Brackenridge Apts., (3). SECRETARY, A. D. Wilkinson, Jr., 1423-B Brackenridge Apts., (3).

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, D. S. Harper, 737 Sammon Ave. SECRETARY, L. S. Mitchell, 88 Lawrence Crescent.



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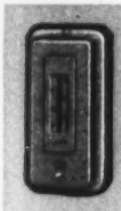

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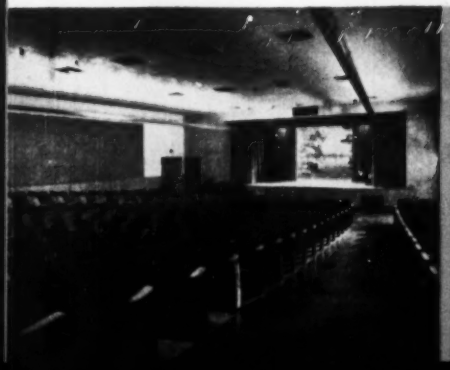

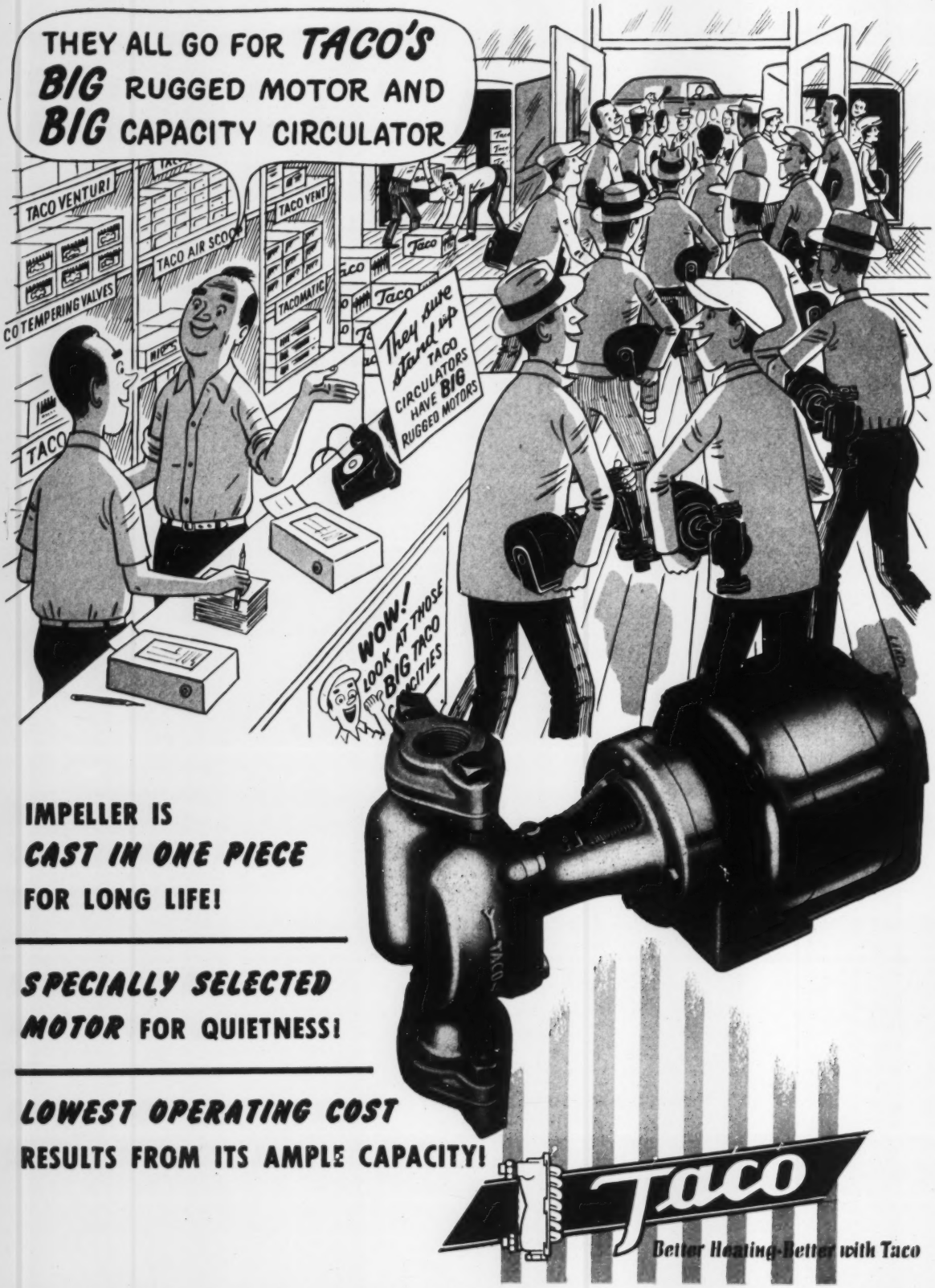
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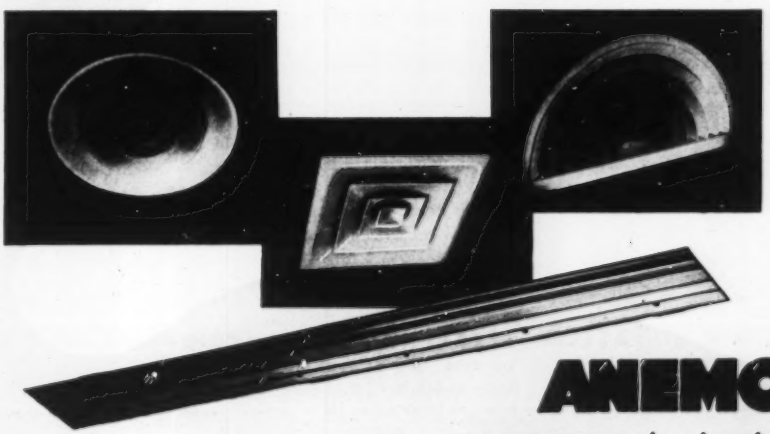

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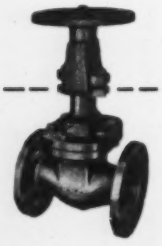

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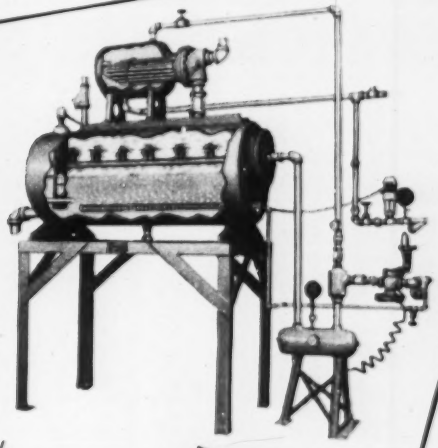

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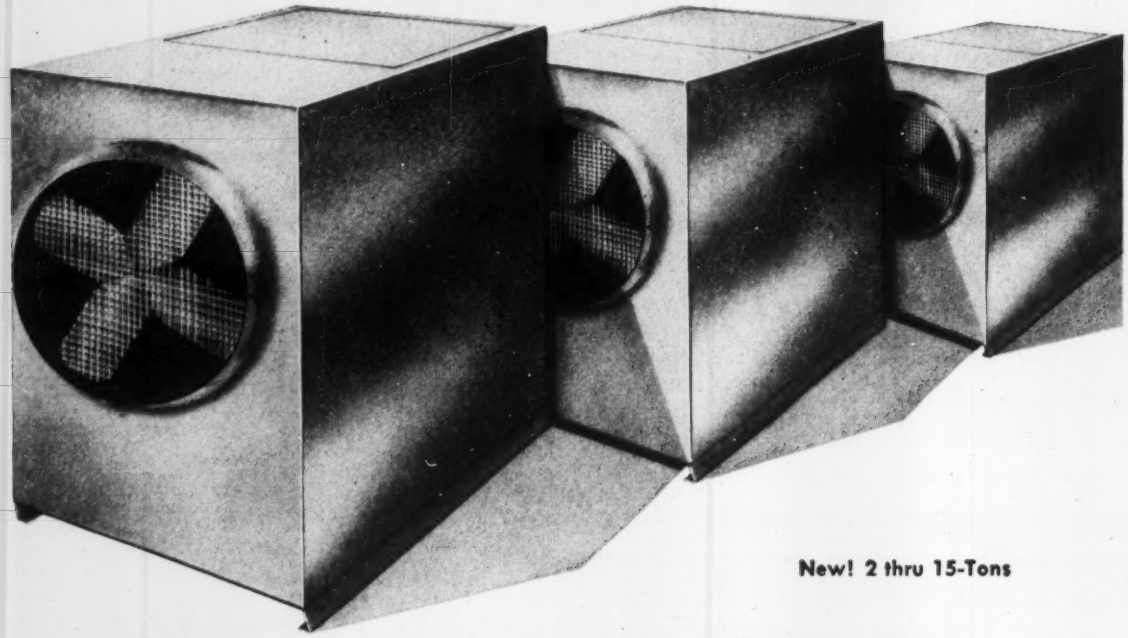

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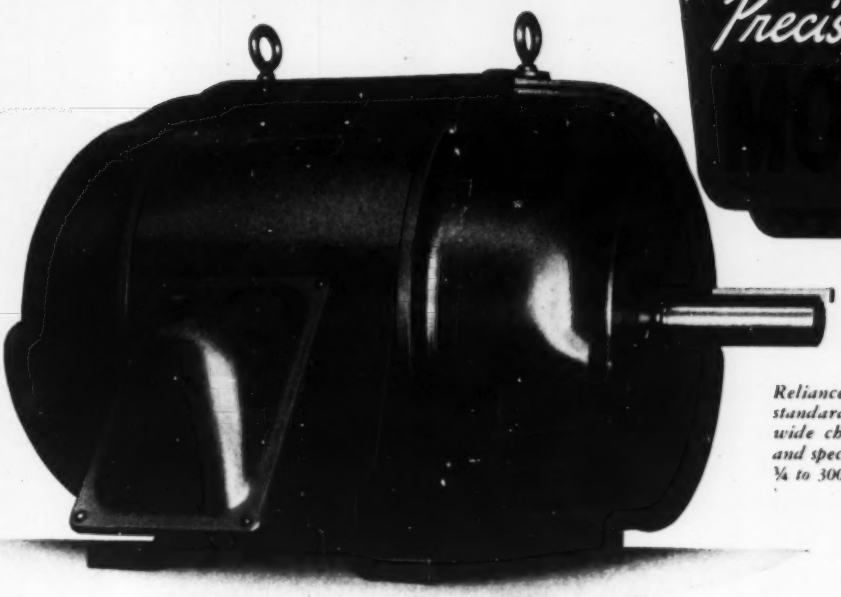

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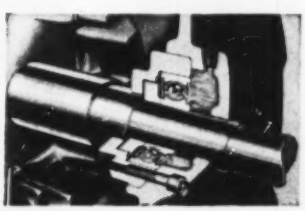

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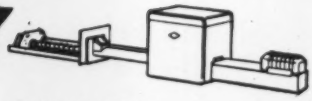


domestic bin feed stoker

WILL-BURT BIN FEED STOKER

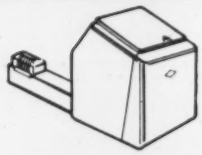
Capacities cover both domestic and commercial requirements.

commercial bin feed stoker

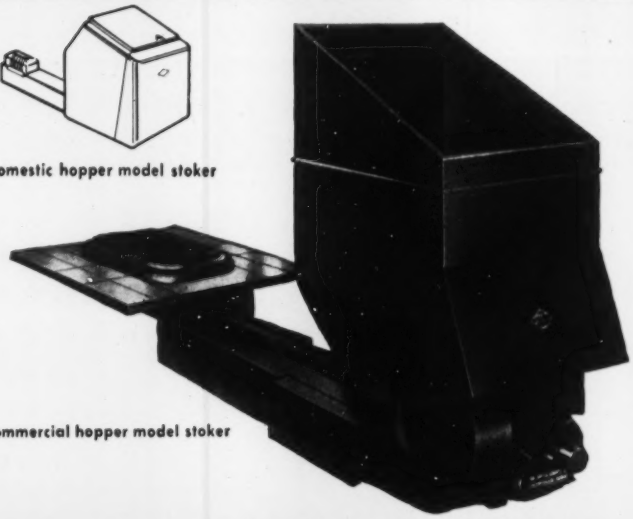
Selling stokers is more than just a good stock turnover . . . it's selling reliability and satisfaction, too. Satisfied customers actually become good-will salesmen—paving the way for your future profits. This Will-Burt bin feed stoker is designed for commercial and domestic installations wherever bituminous coal is burned. And look at the features! Exclusive automatic air control . . . patented protective shear pin . . . precision machined power unit. A patented flange and set screw locking device prevents the coal screw from disengaging from the drive shaft. Auxiliary air supply prevents back smoking. Sell satisfaction—sell Will-Burt.

WILL-BURT HOPPER MODEL STOKER

This Will-Burt Hopper Model Stoker also has capacities to cover your domestic and commercial needs. Equipped with the exclusive automatic air control for delivering correct quantities of air under constantly changing fire bed conditions. If an overload occurs—a protective pin shears, and an automatic switch stops the motor and fan. Strong, cast iron hopper base; heavy gauge rust-resisting steel hopper. Yes, Will-Burt is your key to increased stoker sales. Why not drop us a card or letter today . . . we'll be glad to give you more information concerning Will-Burt products and dealer arrangements.



domestic hopper model stoker



commercial hopper model stoker

THE WILL-BURT COMPANY

BOX 902 ORRVILLE, OHIO

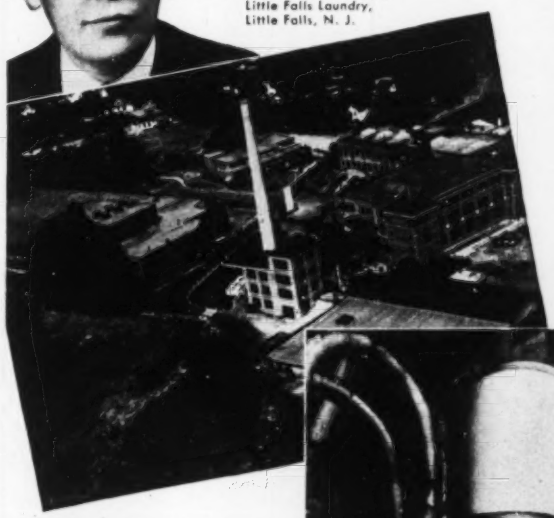
STOKERS • RESIDENTIAL BOILERS • OIL AND GAS CONVERSION BURNERS

"How we save $20,000 a year—USING COAL INSTEAD OF OIL"

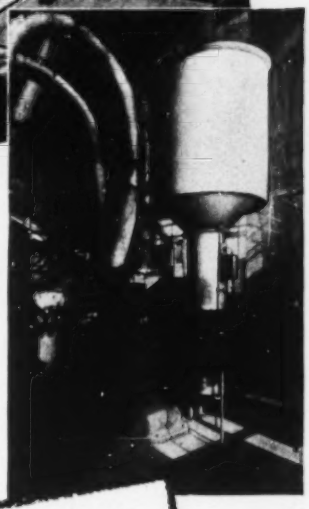
Louis G. Notte,
Chief Power Engineer,
Little Falls Laundry,
Little Falls, N. J.

(ACTUAL CASE HISTORY OF THE LITTLE FALLS LAUNDRY, LITTLE FALLS, N. J.)

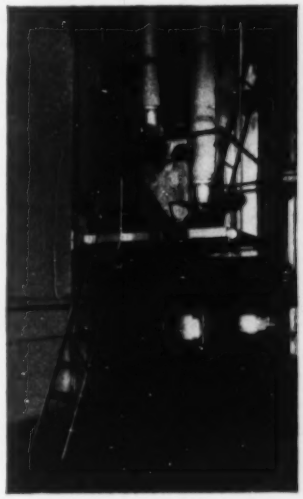
"Our laundry is one of the largest in the country," says Chief Power Plant Engineer Notte, "and, we think, one of the most progressive. Our company insists on superior performance at lowest possible cost all along the line. That's exactly why we depend on coal-fired equipment. From coal we get the daily amount of BTU's we need at a cost of $200—to get the same BTU's from oil would cost $280. We can change to oil on less than a day's notice—but so far we've *never* done it. Coal does a great job—cheaper."



To this plant in Little Falls 500 employees come to take care of the laundry for an estimated 100,000 people. And from this plant 100 trucks travel to customers across a 5,000 square-mile area! The laundry depends on coal to provide all electric power and lights—heat for all buildings—steam for hydraulically-operated machines—steam for pressers and dryers.



The pulverizer from which coal is blown into the boiler. Before this operation, the laundry employs a conveyor belt to feed a precrusher. From there, conveyors carry the coal to the 100-ton hopper which feeds the pulverizer. *Modern coal devices slash labor costs—make coal's basic economy even greater.*



A section of the modern coal-fired boiler. With equipment like this it's possible to add 10% to 40% to the power derived from the same amount of coal in years past—to bring over-all boiler efficiency to 85% or more.

If you're running your own steam plant, here are a few down-to-earth facts you don't want to miss!

COAL in most places, is today's most economical fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U. S. A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that American industry can count on more and more—for with modern combustion-and-handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

● Plants that use coal are in an enviable position—at the present *and* for the future. *For they are more certain than the users of other fuels of a dependable fuel supply—at stable prices.* The reasons are compelling. Of America's total fuel reserves, 92% is coal: Even today, oil is *imported* while this country can and does *export* coal. In addition—this country's mines are the most highly mechanized and efficient in the world.

To get *all* the great economy that coal is capable of delivering—to find out how much more efficient and dependable a job coal and the very latest coal-fired equipment can do—call in a competent consulting engineer. He'll recommend the right equipment for your specific needs. Then you'll see exactly why coal *on a performance basis, on a dollars-and-cents basis . . .* is your best fuel buy, by far!

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

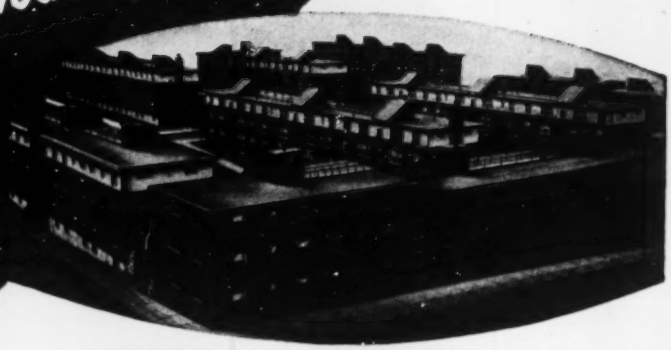
ANOTHER REPORT OF READING COPPER TUBING "ON THE JOB" . . .

New England Pl...

Installs READING COPPER TUBE Exclusively in 274-Unit Housing Project!

...Kahn

Melvin Kahn



WEST ROXBURY HOUSING PROJECT, BOSTON, MASS.

ARCHITECT: Somes, Boyden, Griswold and Ames, Boston, Mass.

PLUMBING CONTRACTOR: Benjamin Kahn & Son, Medford, Mass.

The 274-unit West Roxbury Housing Project just erected for the City of Boston Housing Authority is the most recent installation in which Benjamin Kahn & Son, plumbing contractors of Medford, Mass., has used Reading Copper Tube exclusively.

The Kahn firm has been in business since 1926 and estimate they have installed approximately 581,395 feet of Reading Copper Tube in the past 5 years. They have learned from this long experience that Reading Copper Tube can be depended on for uniform wall thickness, precision manufacture to close tolerance standards, and reduced labor cost resulting from the elimination of many joints and fittings which is made possible by the ease of bending Reading Copper Tube on the job.

These important qualities are winning a steadily growing preference for Reading Copper Tube by plumbing and heating contractors everywhere for hot and cold water lines, radiant heating installations, air conditioning systems, underground service and processing lines.

Whenever you order copper tubing from your plumbing and heating supply wholesaler, remember to specify Reading . . . for a better job at less cost!

READING TUBE CORPORATION

Producers of Reading Lektrenseal Copper Tubing and Reading 85% Grade A Red Brass Pipe

READING COPPER · BRASS TUBING

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A 3-YEAR WARRANTY

CHRYSLER AIRTEMP COMPRESSORS WARRANTED 5 YEARS

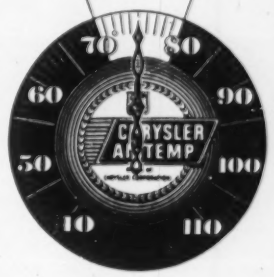
Little more than a year ago, Chrysler Airtemp first offered an optional 5-year warranty on the sealed radial compressor. Performance records of these compressors in the field have proven their value beyond doubt. Now EVERY compressor used in the famous "Packaged" Air Conditioner is warranted five years at no extra cost.

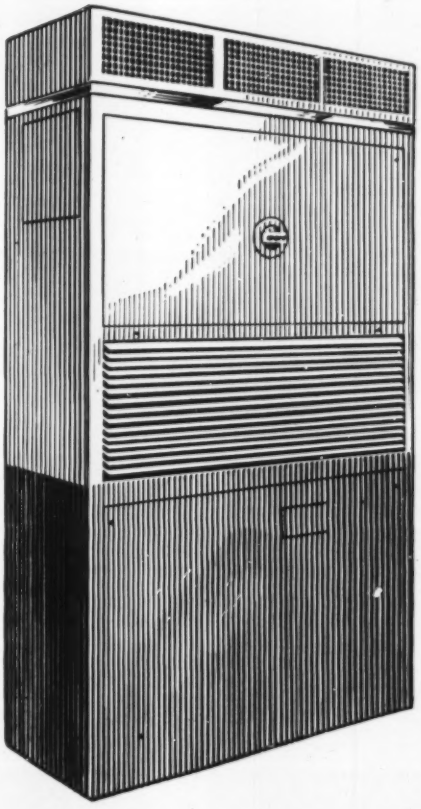
Here are three of the many sound reasons for the amazing performance of these compressors:

1. Wear is reduced through precise machining.
2. Top efficiency at all speeds is assured through radial design.
3. Dirt and moisture are kept out because Chrysler Airtemp compressors are assembled in an air conditioned factory.

Get all the facts today. See why it'll pay you to sell the best in Air Conditioning . . . Chrysler Airtemp "Packaged" Units with the famous radial compressor.

Comfort Zone FOR PROFIT





"Packaged" Air Conditioners
Six models from 2 to 15 H.P. capacity meet every cooling need.

Guaranteed by Good Housekeeping

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AIR CONDITIONING • HEATING
***for* HOMES, BUSINESS, INDUSTRY**

Airtemp Division, Chrysler Corporation, Dayton 1, Ohio

Airtemp Division, Chrysler Corporation HP&AC-6-53
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Please send full detail on the Chrysler Airtemp Comfort Zone "Packaged" Air Conditioning proposition.

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Address _____ Phone _____

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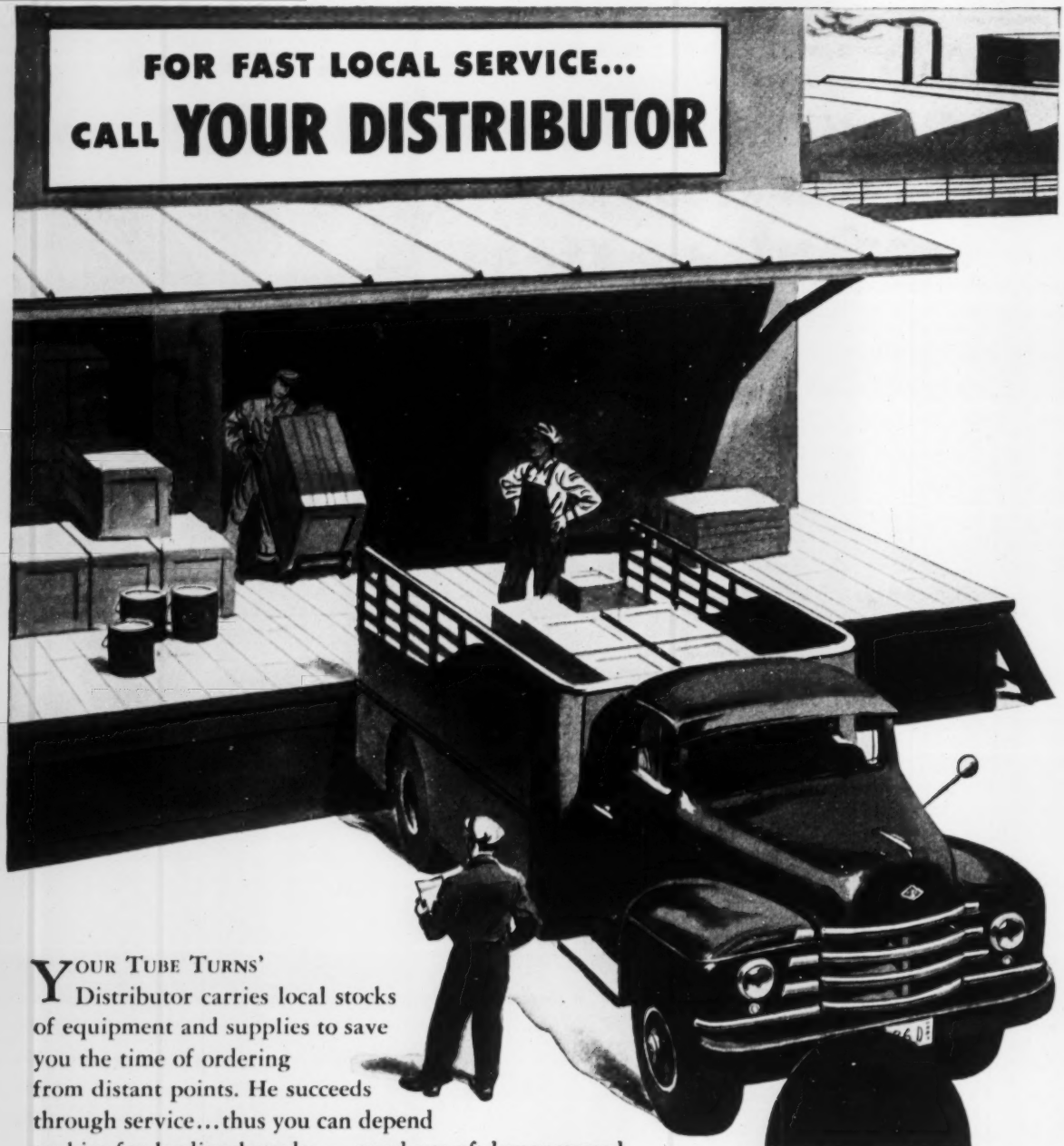
CALL YOUR DISTRIBUTOR



YOUR TUBE TURNS' Distributor carries local stocks of equipment and supplies to save you the time of ordering from distant points. He succeeds through service...thus you can depend on him for leading brands . . . products of demonstrated value, obtainable in a minimum of time.

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The Leading Manufacturer of Welding Fittings and Flanges

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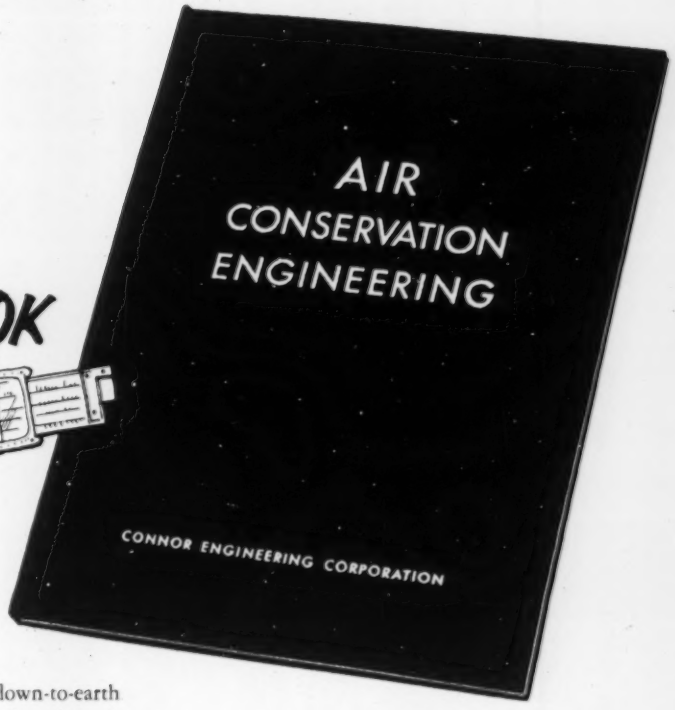
NEW EDITION OF THIS FAMOUS HANDBOOK



Written out of 20 years of experience, this new edition of "Air Conservation Engineering" offers a wealth of factual information—latest theory as well as practical down-to-earth suggestions in this important field of engineering. A publication of Connor Engineering Corporation.

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for better drainage lines

CHASE COPPER TUBE

CHASE

Smooth inside surfaces assure even flow!

Corrosion-resistant, of course!

Entire system lightweight, easily installed!

Fittings trim and compact!

CHASE Copper Fittings are water-tight, pressure-tight!

Chase Copper Tube with Chase Solder-Joint Fittings for waste, vent and soil lines can be installed rapidly . . . more economically...do a better drainage job . . . last longer.

You get a *lightweight system* that can be easily assembled and handled on the job. Pipe and joints are rugged enough to take hard knocks. 20 foot lengths need fewer joints.

For complete information, see your Chase wholesaler.

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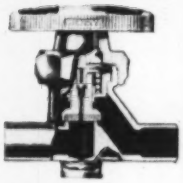
HENRY LINE VALVES really give you something extra

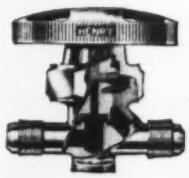
They give more dependable service because of advanced field-proven design and construction as well as patented features.

PACKLESS VALVES FOR FREON with Exclusive Balanced-Action



STANDARD TYPE

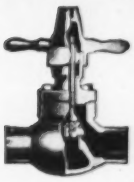
Ball check in balancing channel permits diaphragm inspection and replacement with valves under line pressure. Sizes, ¼" thru ⅝" flare; ¼" thru 1⅜" O.D. Solder, ¼" thru 1" F.P.T.



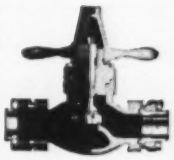
BLUE BANTAM TYPE

Same as standard Balanced-Action valve except that diaphragms cannot be inspected or replaced under line pressure. Size ¼" thru ⅝" flare and O.D. Solder.

PACKED VALVES FOR FREON Bronze-Wing Cap Type



Globe and angle types with solder connections, bolted bonnets, sizes ⅞" thru 5⅛" O.D.



SEMI-STEEL WING CAP TYPE

With bolted bonnets and square companion flanges. Furnished with brass tailpieces (O.D. Solder) 1⅜" thru 6⅛" or with steel tailpieces for welding to pipe, sizes 1¼" thru 6".

Also Globe and angle types with F.P.T. connections, sizes ½" thru 2".

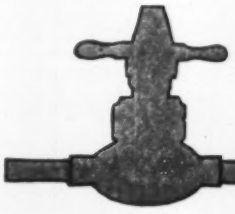
PACKED VALVES FOR AMMONIA Permanent-Mold Iron and Semi-Steel

Compact and strong with self-aligning stem disc. Sizes (F.P.T.), screw bonnet: ¼" thru 1", bolted bonnet 1¼" thru 2"—with flange connections 1¼" thru 5".

HENRY—Standard equipment by leading Manufacturers, Army, Navy, Coast Guard and Maritime Commission • Stocked by Leading Jobbers

WRITE FOR CATALOGS

HENRY VALVE CO.



HENRY VALVE CO. CONTROLLING FLOW SINCE 1914

Valves—Driers—Strainers—Control Devices and Accessories for Refrigeration, Air Conditioning and Industrial Applications

MELROSE PARK, ILL. (CHICAGO SUBURB)
CABLE: HEVALCO, MELROSE PARK, ILLINOIS

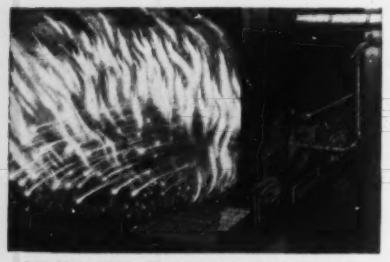
®

Iron Fireman

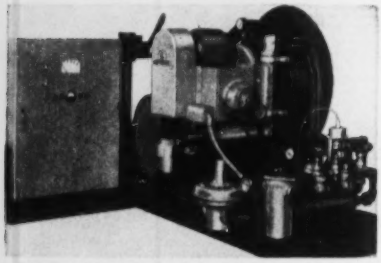
Dual or Triple Fuel Firing

uses OIL, GAS or COAL

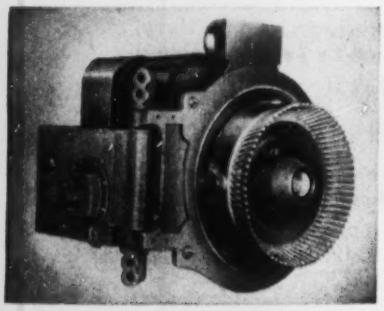
With this Iron Fireman installation the Hyde Park Laundry is able to burn coal, oil or gas at any time desired. Steady steam supply is required for both heating and processing.



GAS, OIL, COAL. Equipment includes Ring Type gas burner, Rotary oil burner, and Pneumatic Spreader coal stoker. Coal is automatically dried, preheated and conveyed from bunker to boiler. No manual handling; no costly conveying equipment.



GAS-OIL PACKAGE UNIT. For Scotch marine and other types of boilers. Has integral forced draft and control panel which is completely wired and tested at factory.



GAS-OIL BURNER. Ring Type gas burner and Rotary oil burner on single mounting. Fuels can be shifted quickly, with no loss of efficiency.

Fuel switch saves $510 in two months . . .

Hyde Park Laundry, Chicago, cuts costs by quick changeover

"Our past experience with our Iron Fireman stoker led us to investigate your gas and oil units along with several other makes," writes Mr. Morris Tabas, Manager of the Hyde Park Laundry. "Now we have Iron Fireman three-fuel operation—coal, gas and oil. With quick changeovers we needn't fear shortages, strikes, or what have you.

"During a two-months' period when we took advantage of seasonal gas rates, our fuel cost was $690 as compared to $1,200 with other fuels for a like period and load."

Burns all fuels efficiently

Efficiency ratings are high with oil, gas or coal. As price advantage shifts from one fuel to another your steam plant can shift with it—for the long pull if necessary. Or you can change fuels every day when desirable. This is routine practice in many companies where the gas supply is reduced during peak periods.

Avoid costly shut-downs

Fuel emergencies, due to interrupted or short supply, can be disastrous. Yet protection may cost little or nothing when offset by the fuel and labor savings of Iron Fireman multiple fuel firing.

For further information write Iron Fireman Mfg. Co., 3067 West 106th Street, Cleveland 11, Ohio.

Iron Fireman

AUTOMATIC FIRING
FOR HEATING, PROCESSING, POWER

Steak was really "rare" in the 90's

At the turn of the century the "butcher's wagon" was a familiar sight. For many rural families it was their only meat market.

Electric refrigeration has revolutionized food marketing, but equally important are the benefits to public health. Now, you can keep your steaks in the "pink of condition" for one day or fifty-two weeks, as you choose.

The volume production of dependable and efficient Emerson-Electric Hermetic Motors has been a contributing factor in making modern refrigerators and food freezers economically sound investments for millions of Americans.

Leading makers of motorized products for the farm, home, business and industry depend on Emerson-Electric's 62 years of motor building experience. For information on this complete line of standard motors in ratings from 1/20 to 5 h.p., and hermetic motors from 1/8 to 20 h.p., write:

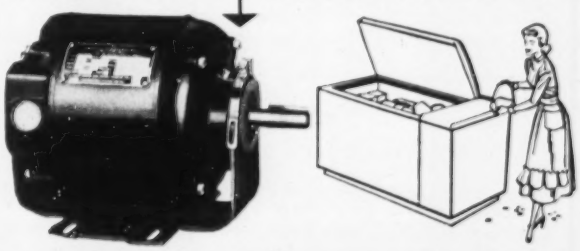
THE EMERSON ELECTRIC MFG CO., St. Louis 21, Missouri

MODERN LIVING IS POWERED WITH ELECTRIC MOTORS

Write for these Emerson-Electric Motor Data Bulletins

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ M414-A Capacitor-Start
- ☐ M414-B Split-Phase
- ☐ M414-C Integral
- ☐ M414-D Fan-Duty
- ☐ M414-E Oil-Burner
- ☐ M414-F Jet Pump
- ☐ M414-G Blower



EMERSON ELECTRIC

MOTORS • FANS APPLIANCES

LEADERS IN THE MOTOR AND FAN INDUSTRY SINCE 1890

It's all there

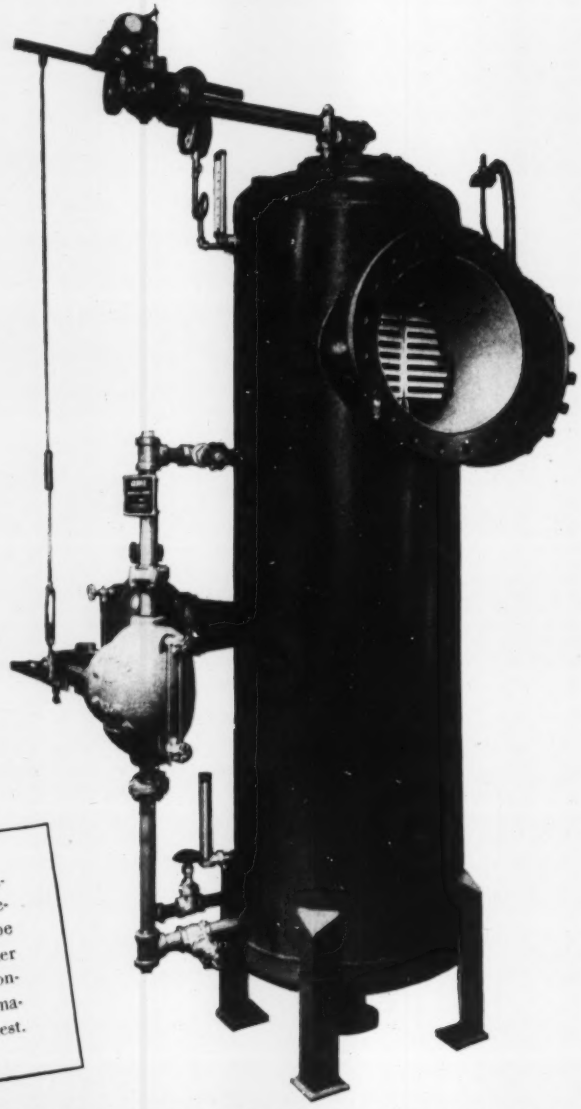
everything needed for easy, quick installation

When you buy a Graver Packaged Deaerating Heater, it comes to you *complete.*

This means that the unit includes *all* internal parts, controls, valves and instruments you need for the installation. There will be nothing to wait for . . . nothing more to buy.

And *shipment* will be quick, too, because these units are *standardized* . . . pre-engineered for your speedy selection from a wide range of capacities in either the spray or spray-tray types.

While these Graver Packaged Heaters are built in sizes for the *smaller* plant, every part and every accessory is of the highest quality design, construction and workmanship . . . subjected to the same rigid specifications as the Graver Heaters of 1,000,000 lb. per hr. or more, built for the largest power generating stations.



If you are concerned with the purchase, installation or operation of a deaerating heater for a steam generating plant requiring up to 100,000 lb. per hr. of boiler feedwater, be sure to investigate this Graver Packaged Deaerating Heater of the spray or spray-tray design. Descriptive bulletin containing complete information including dimensional information in a range of standard capacities will be sent on request.

GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

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In Canada: The Bird-Archer Co., Ltd., Cobourg, Ontario

In Mexico: Proveedores Tecnicos, S.A.; Puebla 259, Mexico 7, D.F.

GRAVER ***Packaged Deaerating Heaters***

GW 470

"I could see the corpsman kneeling over me. The blood plasma was running down through a tube into my arm and he said everything was going to be O.K. I was walking across an enemy mine field in Seoul when one exploded and a piece of shrapnel caught me in the leg.

" 'Got enough of that stuff?' I asked him, pointing to the blood. 'I guess we never have enough,' he said, 'but you can thank *somebody* for this pint.'

"How do you thank 'somebody' for blood? For saving your life? When I got back home, I discovered the answer at my local blood donor center. There's only *one* way to say thanks—by giving some of your own blood."

"How do you thank 'somebody' for Blood?"

Yes, all kinds of people give blood—for all kinds of reasons. But whatever *your* reason for giving blood, this you can be sure of: Whether your blood goes to a combat area, a local hospital, or for Civil Defense needs—this priceless, painless gift will some day save an American life!

Business Executives!
✓Check These Questions!

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ☐ Have you given your employees time off to make blood donations?
- ☐ Do you have a Blood Donor Honor Roll in your company?
- ☐ Have you set up a list of volunteers so that efficient plans can be made for scheduling donors?
- ☐ Have you arranged to have a Bloodmobile make regular visits?
- ☐ Has your management endorsed the local Blood Donor Program?
- ☐ Have you informed employees of your company's plan of co-operation?
- ☐ Was this information given through Plant Bulletin or House Magazine?
- ☐ Has your company given any recognition to donors?
- ☐ Have you conducted a Donor Pledge Campaign in your company?

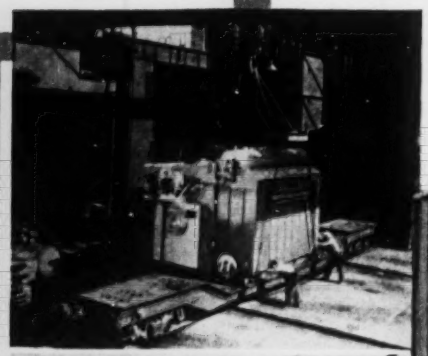
Remember, as long as a *single* pint of blood may mean the difference between life and death for *any* American . . . the need for blood is *urgent!*

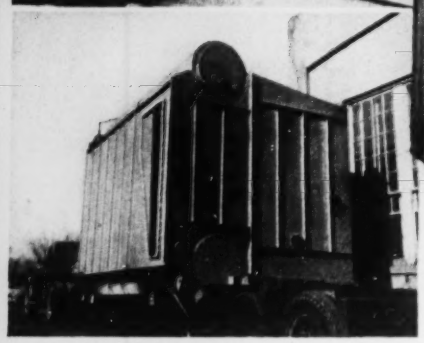
Give Blood Now—Call Your Red Cross Today!

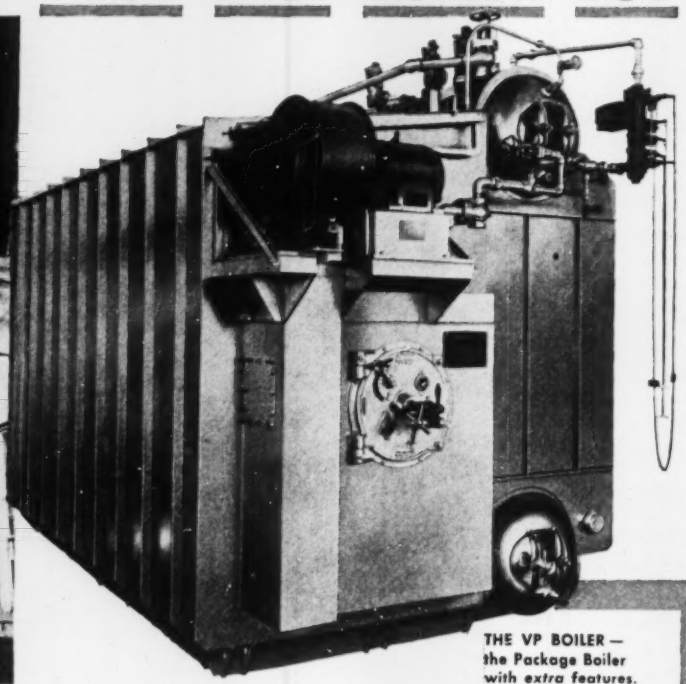
National Blood Program

4 reasons why...

THE VP PACKAGE IS YOUR BEST BOILER BUY







THE VP BOILER — the Package Boiler with *extra* features.

1 Fully Water-Cooled Furnace — More cooling area per cubic foot of furnace volume than any other boiler of the VP's size and type. In all but the three smallest sizes, the VP Boiler has water-cooled walls on *all six sides* — including the burner wall. Assures rapid, efficient heat absorption. Minimizes furnace maintenance.

2 Larger Lower Drum — The 30 in. diameter lower drum permits a simple, symmetrical tube arrangement . . . provides easy access for washing down or inspection . . . its greater water storage capacity facilitates the handling of fluctuating loads.

3 Simple Baffle Arrangement — Minimum changes in direction — no baffle at all in convection bank in larger VP Boilers. This means lower draft loss . . . simplified soot blowing . . . elimination of dead pockets, thus, maximum heat pick-up. In the intermediate sizes, a water-cooled baffle assures minimum maintenance.

4 Centrifugal Fan — This more efficient type of fan operates at lower speed than other types and is quiet in operation. In fact, its average noise level is less than half that of typical high-speed blowers used in most package boilers.

These four *extra* features are yours *only* in the VP Boiler which is designed and manufactured by Combustion — maker of many of the world's largest boilers. These units are available in capacities ranging from 4,000 to 30,000 lb of steam per hr, and pressures up to 250 psi.

Complete details on the C-E Package Boiler, Type VP, are available to you. Send for your free copy of Bulletin VP-181.

B-666B

COMBUSTION ENGINEERING, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

ALSO DESIGNERS, MANUFACTURERS OF BOILERS, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

an ACCO product

How R-P&C Valves Reduce Maintenance Costs...

• Six important features of R-P&C Cast Steel Valves eliminate many service troubles which in turn reduces maintenance costs.

First of all . . . they're made from electric furnace steel which means sound castings. All parts are designed for equal strength and great toughness. The bodies resist distortion. Permanent alignment is provided by the rigid one-piece yoke. And the gland packing stays tight even at high pressures and temperatures. Furthermore, the design detail assures smooth flow and positive shut-off.

You can get R-P&C Cast Steel Valves in gate, globe, angle, stop and check, and swing check types. Variety of trim metals for air, gas, liquid, oil, steam, water. Wide range of pressures and temperatures. Screwed, flanged, or welding ends. Sizes range from 1½" to 24".

Specify . . . and *get* . . . R-P&C Cast Steel Valves next time you order from your distributor.

R-P&C valves

ACCO

TRADE MARK

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

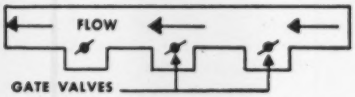
Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

CANTON STOKERS

flo-tubes

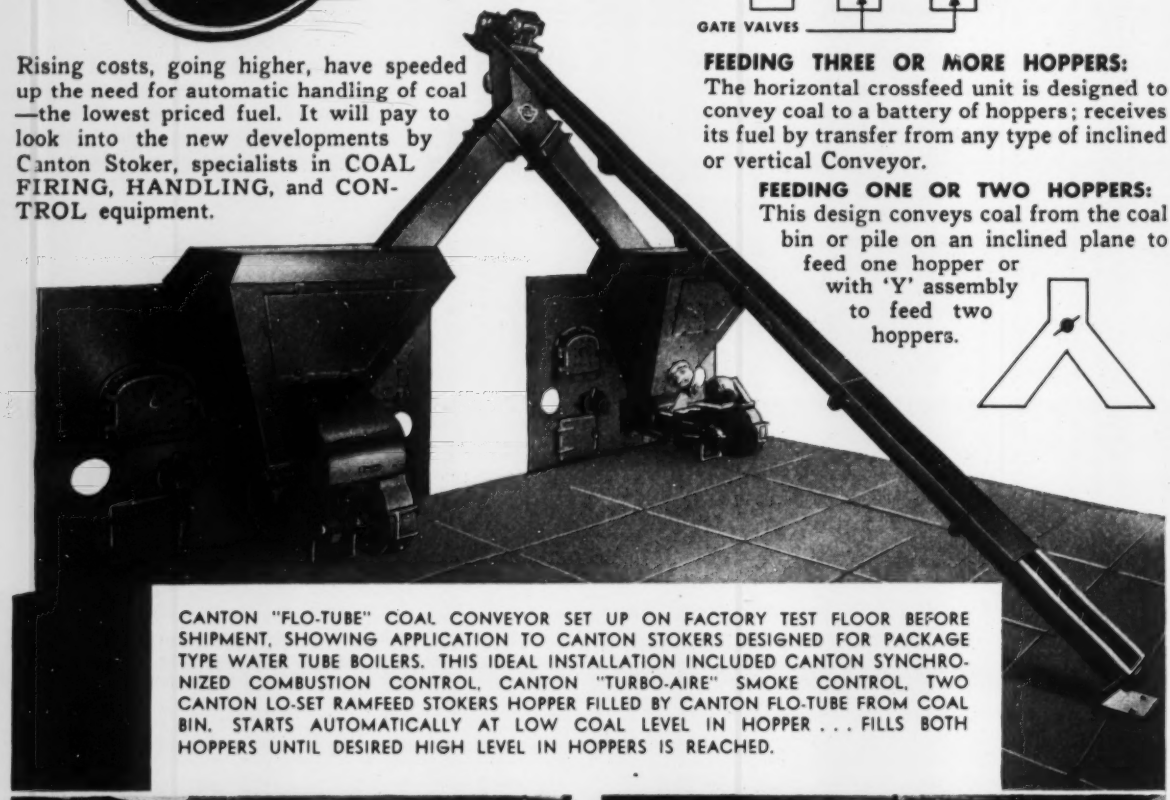
WHEN COAL GOES UP THIS WAY . . . LABOR COSTS COME DOWN

Rising costs, going higher, have speeded up the need for automatic handling of coal —the lowest priced fuel. It will pay to look into the new developments by Canton Stoker, specialists in COAL FIRING, HANDLING, and CONTROL equipment.

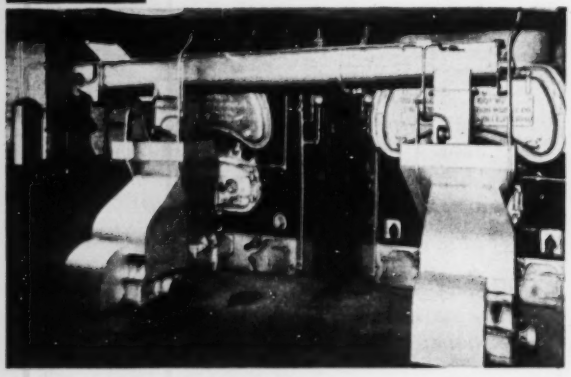


FEEDING THREE OR MORE HOPPERS: The horizontal crossfeed unit is designed to convey coal to a battery of hoppers; receives its fuel by transfer from any type of inclined or vertical Conveyor.

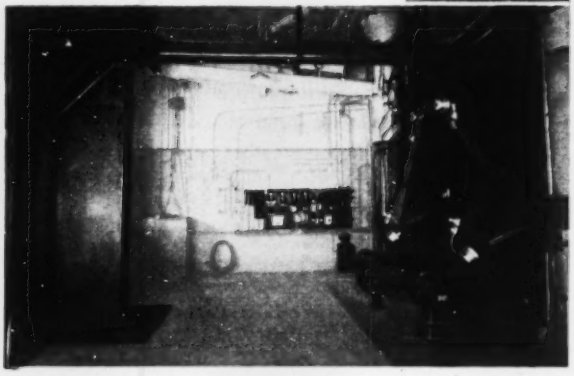
FEEDING ONE OR TWO HOPPERS: This design conveys coal from the coal bin or pile on an inclined plane to feed one hopper or with 'Y' assembly to feed two hoppers.



CANTON "FLO-TUBE" COAL CONVEYOR SET UP ON FACTORY TEST FLOOR BEFORE SHIPMENT, SHOWING APPLICATION TO CANTON STOKERS DESIGNED FOR PACKAGE TYPE WATER TUBE BOILERS. THIS IDEAL INSTALLATION INCLUDED CANTON SYNCHRONIZED COMBUSTION CONTROL, CANTON "TURBO-AIRE" SMOKE CONTROL, TWO CANTON LO-SET RAMFEED STOKERS HOPPER FILLED BY CANTON FLO-TUBE FROM COAL BIN. STARTS AUTOMATICALLY AT LOW COAL LEVEL IN HOPPER . . . FILLS BOTH HOPPERS UNTIL DESIRED HIGH LEVEL IN HOPPERS IS REACHED.



INSTALLATION AT A LARGE BAKERY IN PENNSYLVANIA. CANTON LO-SET RAMFEED STOKERS FOR ANTHRACITE COAL INSTALLED UNDER STEEL FIREBOX POWER BOILERS, INCLUDING BIN-TO-HOPPER COAL CONVEYOR AUTOMATICALLY CONTROLLED, PLUS CANTON COMBUSTION CONTROLS.



THIS EFFICIENT LAYOUT FEATURING CANTON STOKERS AMPLY FULFILLS EVERY HEAT AND POWER DEMAND OF A HUGE FURNITURE WAREHOUSE AND SALESROOM IN MICHIGAN. COAL ELEVATOR AT LEFT, FLO-TUBE DIRECTLY OVERHEAD.

CANTON STOKERS

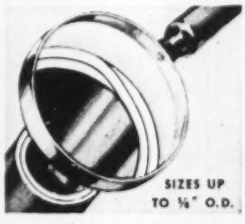
CANTON STOKER CORPORATION

2400 ANDREW PLACE S. W. • CANTON, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES — OR WRITE DIRECT FOR COMPLETE INFORMATION ON: FLO-TUBE SYSTEMS; BINFEED STOKERS; TURBO-AIRE SMOKE CONTROLS AND ALL MODELS OF CANTON STOKERS.

Extra-rugged, lightweight Bundyweld Tubing handles easily on job site. Won't dent under usual rough handling. Bent by one man, positioned by two, Bundyweld saves time and costs.

Let competition eat your dust; be first with Bundyweld Ceiling Radiant Heating



Key to Low Cost

Bundyweld is the only tubing double-walled from a single strip, copper-brazed through 360° of wall contact. It's leak-proof, thinner-walled, yet stronger. It transmits heat quickly, has high bursting strength. It saves on material costs and installation time.

Standard 20′ lengths of Bundyweld are easily formed into coils in shop or on job site. Expanded ends (furnished when specified) are quickly soldered into leak-proof union. Joined, lightweight coils are easily mounted onto ceiling, quickly plastered over.

Now's the time to let late-starting competition eat your dust, while you run up a lasting lead . . . with the heating system that makes others obsolete.

Satisfied users in hundreds of communities have learned that Bundyweld Ceiling Radiant Heating is free of drafts, dust, soot; is noiseless, even-temperatured and economical; eliminates space-robbing radiators and registers; postpones costly redecorating for *years*. With all these solid advantages, it installs with "one, two, three" ease.

Thousands of prospective home builders and buyers hear these user reports, read Bundy ads in *Better Homes & Gardens, American Home, House Beautiful,* and *Small Homes Guide.* Interest turns into enthusiasm; we've answered a small blizzard of requests for literature and *names* of local plumbing and heating contractors handling Bundyweld Ceiling Radiant Heating.

You'll profit *most* by being the *first* in your area to offer what's so obviously wanted – the first big heating advance in years. Why not mail coupon tonight?

Radiant Heating Division
BUNDY TUBING COMPANY
Detroit 14, Michigan

SEND FOR FREE LITERATURE!

Bundyweld
Ceiling Radiant Heating

Radiant Heating Division, Dept. HP-653
Bundy Tubing Company, Detroit 14, Michigan

☐ Send free 20-page nontechnical brochure explaining Bundyweld Ceiling Radiant Heating.
☐ Send Bundy technical radiant heating pamphlet.

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Company _____
Address _____
City _____ Zone ____ State _____

"We now buy only *SKIL* tools for both shop and field use"

says **Bob Lautenboch,** Secretary,
Corn States Metal Fabricators, Inc.,
Des Moines, Iowa

"Our reasons for standardizing on SKIL tools," Mr. Lautenboch continues, "are their popularity with the men who use them plus the excellent factory branch service we get."

Below—W. L. Blythe, foreman for this general sheet metal contractor, uses a Model 11 SKIL Disc Sander to sand a flange on a chute for a cement company. "Our men like these tools," he says, "because of their excellent design, balance and performance. On some of these jobs it's rough going, but with SKIL tools' compact, portable power going right out in the field with us, our jobs go in fast."

SKIL Disc Sander
Model 11

Heavy-duty sander—a very powerful tool for rough sanding, cleaning or grinding jobs. Uses cup grinding wheels or wire cup brushes up to 5" diameter, or discs up to 7". No-load speed 4200 r.p.m. Over-all length 16¾" not including pad. Net weight 11¾ pounds.

SKIL
PORTABLE TOOLS

Made only by SKIL Corporation
formerly SKILSAW, Inc.
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34 SKIL Factory Branches

SEE YOUR DISTRIBUTOR FOR COMPLETE INFORMATION OR CALL YOUR NEAREST SKIL FACTORY BRANCH

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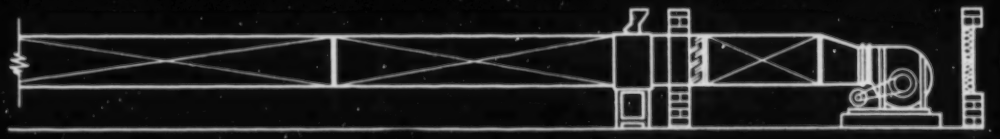
duct furnaces are manufactured by the

HAYES Furnace Co.

used in series with coolers and refrigeration systems for longer life

Please write for catalog and nearest representative



KEWANEE

STEEL BOILERS

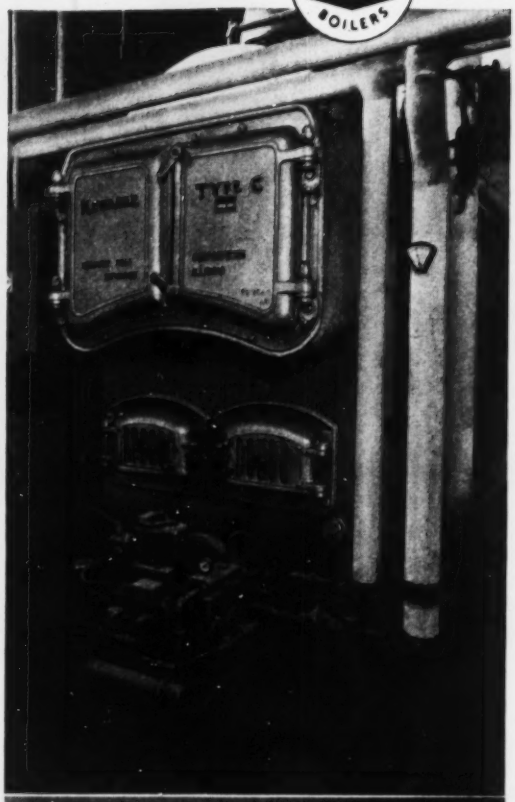
KEWANEE BOILERS

MORE ENGINEERING
MORE MATERIAL
MORE EXPERIENCE

MAKE THE DIFFERENCE

The irreplaceable part of every product is the name and reputation of the maker! Today, the name Kewanee stands for the best in steel boilers . . . as it has for over 80 years. And that is true because Kewanee puts more into them . . . more engineering, more material, more labor and more experience. Owners *expect to get and do get more from them.*

Kewanee Type "C", selected for Saint Stephen School, Saginaw, Michigan, is outstanding among boilers for low-pressure heating. The Kewanee *Corrugated Crown Sheet* adds strength and exposes more heating surface to the hottest part of the fire, so it is a very fast steamer. Compact in design it requires less floor space, yet operates with complete efficiency even when pushed well beyond its rated capacity.

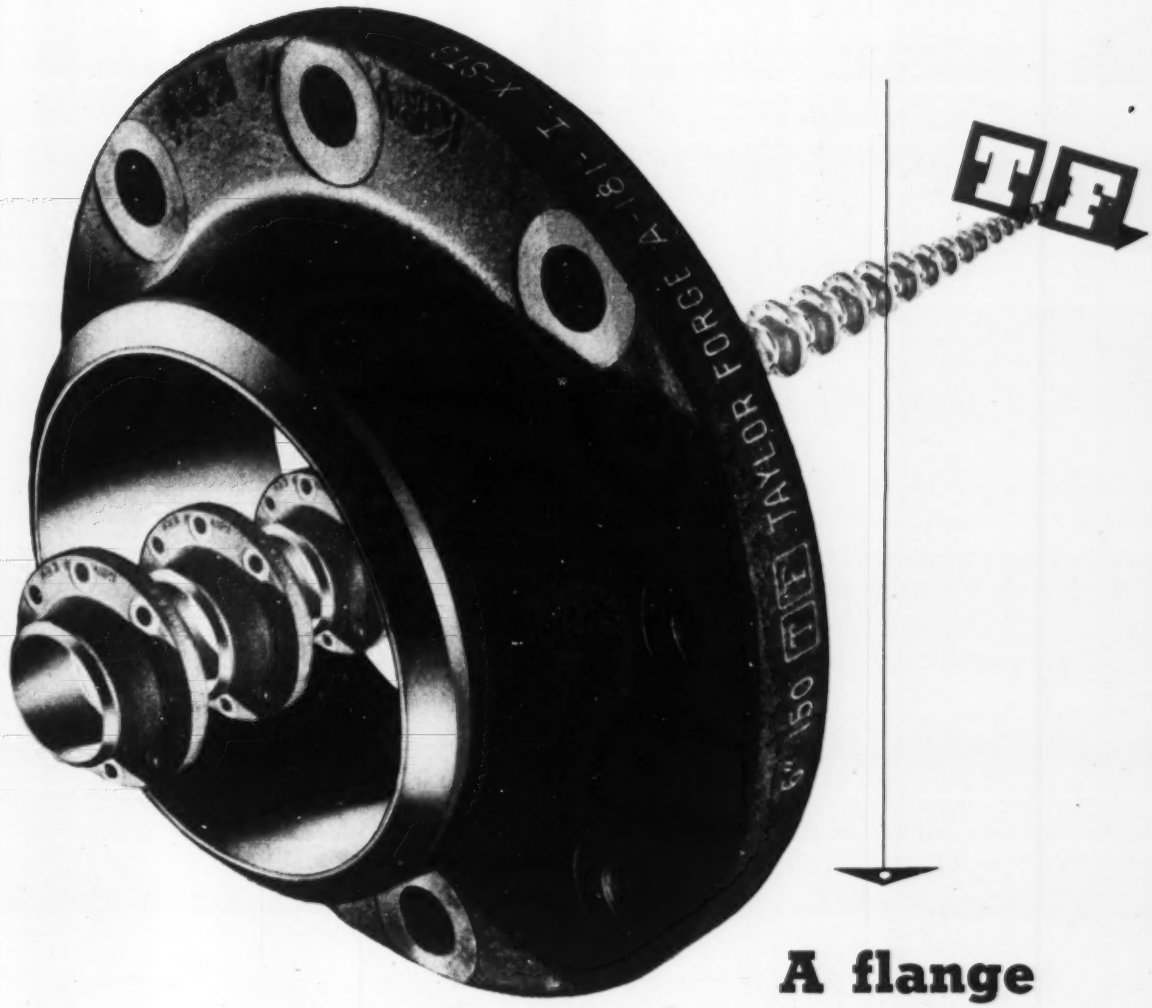


KEWANEE-ROSS CORPORATION
Division of American Radiator & Standard Sanitary Corporation
KEWANEE, ILLINOIS

SAINT STEPHEN SCHOOL
Saginaw, Michigan
FREDRICK E. WIGEN, Architect
RICHARD F. SNYDER, Engineer
Oil-Fired KEWANEE Type "C"
installed by
HANSEN-SNYDER CO., Saginaw

Serving home and industry

AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON



A flange with a background . . .

You are looking at a flange with a history. Taylor Forge made the forged steel flange and in a sense the forged steel flange made Taylor Forge. It was Taylor Forge, back in 1905, who made the first forged steel flanges on a commercial scale . . . and it is Taylor Forge who has guided flange development across the past half century.

Through the first threaded flange form, the bolted Van Stone form, and the perfected welding neck form pictured here, Taylor Forge has undeniably contributed more to flange development than any other organization*.

Taylor Forge Welding Neck Flanges are a part of the WeldELL® line—the line that more than 20 years ago gave industry the first complete line of fittings for pipe welding. The organization that led development is still leading . . . in scope of types, sizes, weights, materials . . . in quality and downright value!

For up-to-the-minute facts see your Taylor Forge Distributor

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS, General Offices & Works: P.O. Box 485, Chicago 90

Plants at: Carnegie, Pa., Fontana, Calif., Gary, Ind., Hamilton, Ont., Canada

* When pressures rose from the old 150- and 300-pound standards to 400, 600 and finally 900 pounds, it was largely the exhaustive research of Taylor Forge that supplied the formulas for determining stresses in flanges for any given condition of loading. Among many examples: the Taylor-Waters formula, published in 1927, became and still is the basis of recognized practice for flanges in sizes through 24". Again, in 1938 Taylor Forge published the first edition of the now authoritative "Modern Flange Design" based on methods proposed by E. O. Waters, D. B. Rossheim, D. B. Wesstrom and F. S. G. Williams, Taylor Forge Manager of Engineering Standards. (ASME Trans., Apr. 1937)

Remove Odors with *Pur Air* Adsorbers

completely adaptable . . .

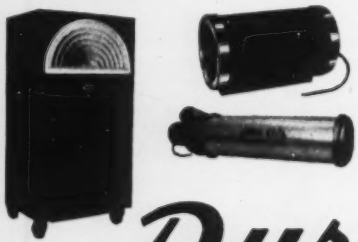
easily installed in any system

Using the proved principle of the gas mask, adsorption by activated carbon, Pur Air equipment will positively remove odors. A faint smell of violets or a deadly concentration of chlorpicrin gas . . . either is absorbed and retained by Pur Air activated, coconut-shell carbon.

The Pur Air Filter-Fold unit above can be used singly or in combination to fit the system. Accordian-like construction provides maximum adsorbing surface. Since the amount of carbon determines effective life, it is important to know this unit contains 44 lbs. of guaranteed 50-minute, activated, coconut-shell carbon. Tests of over 15,000 materials proved that to be the best for odor and gas adsorption.

Wherever you encounter an odor problem, you can profit by the help of a Pur Air engineer. Call him in without obligation. Seventy sales offices are at your service.

Pur Air, self-contained odor-removal units



Shown at left are several Pur Air units that are ready to plug in and start removing odors. There are sizes for any enclosed area . . . small lavatories, large warehouses, taverns, restaurants, hospital rooms, kennels, homes, offices, and a hundred others. Give us an idea as to the size area with the odor problem and we'll give you data about the Pur Air unit to correct it.

Pur Air DIVISION
BARNEBEY-CHENEY *Company*
MANUFACTURERS OF ACTIVATED CARBONS

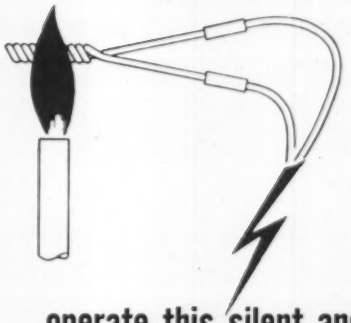
N. Cassady and Eighth Aves., Columbus 19, Ohio

SOLVENT RECOVERY DIVISION: Complete Solvent Recovery Systems

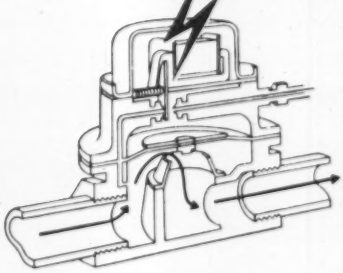
SELF-POWERED
SILENT
SAFE

General Controls is the originator and pioneer manufacturer of self-generating gas heat control systems. General Controls' BX-69 package set consists of only three components: (1) a pilot-generator, operating on the dependable thermocouple principle of electric power generation, (2) a diaphragm-type gas valve, designed for positive safety and silent, trouble-free service, (3) a sensitive room thermostat, encased in lustrous metal that harmonizes with every interior decoration theme. The General Controls BX-69 all-gas control system . . . is the first and still foremost in the gas heat control field.

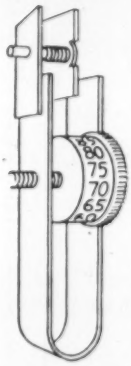
This pilot flame generates the electricity to



operate this silent and safe gas valve at



the demand of this sensitive and accurate room thermostat



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Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls for Heating, Home Appliances, Refrigeration, Industrial and Aircraft Applications.

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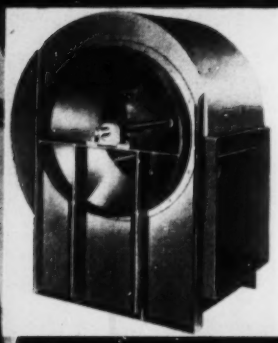
by a foremost designer!



HAROLD F. HAGEN, internationally recognized authority designed this outstanding "Chicago" Airfoil Fan

THE NEW

CHICAGO airfoil fan

Most sensational improvement in 40 years!

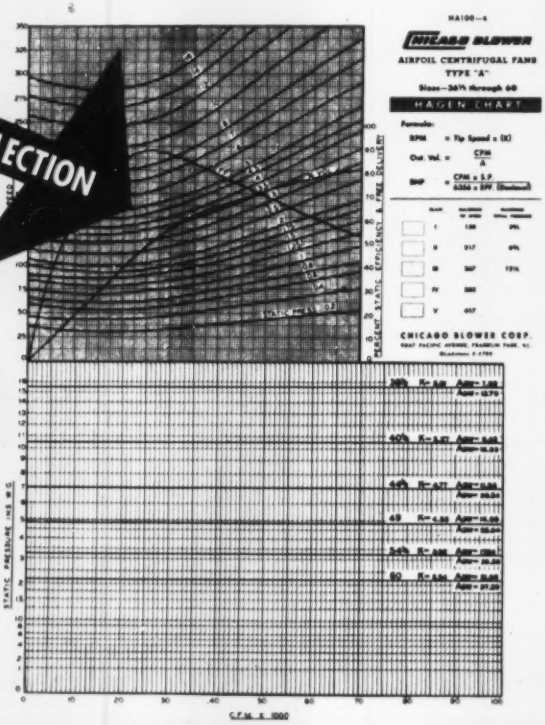
40% Quieter! Efficiencies in Excess of Ninety percent! 20% less H.P.

APPLICATIONS
- *Heating and ventilating*
- *Industrial and commercial ventilation*
- *High pressure air conditioning*
- *Induced and forced draft*

VOLUME • *600 to 750,000 CFM*

STATIC PRESSURE • *⅛ to 32 inches*

NOW! Hagen Charts for PROPER FAN SELECTION



- Permits at-a-glance fan selection
- Choice between operating cost or original cost
- Shows point of rating and efficiency on fan curve
- Fan performance curve available immediately

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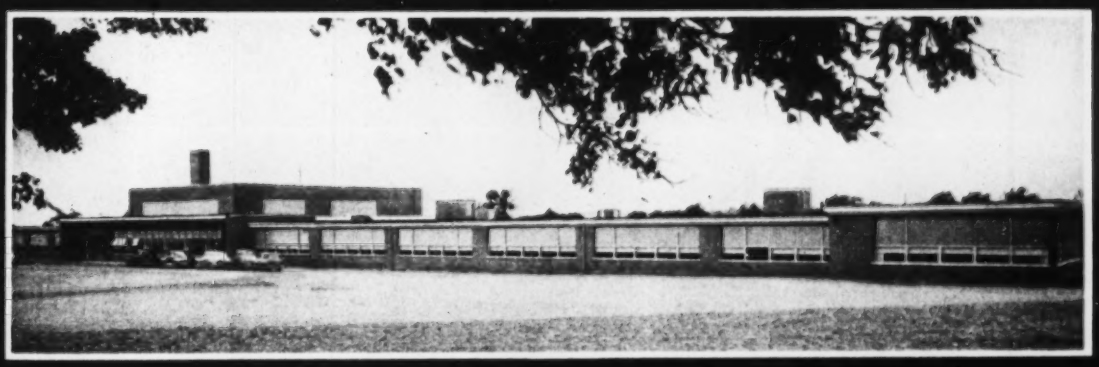
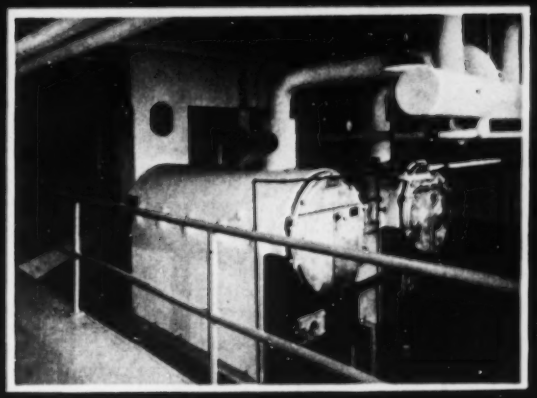
Architect: Hampson and Fisher, Pittsfield, Mass. **General Contractor:** Ernest J. Cramer, Pittsfield, Mass. **Plumbing & Heating Contractor:** Berkshire Plumbing and Heating Company, Pittsfield, Mass. **Insulation Contractor:** Armstrong Cork Company, Hartford, Conn.



Featherweight 85% MAGNESIA

Earns A-Grades for Keeping School's Steam HOT!



Central School, Philmont, N.Y., protects its pupils with a modern heating system insulated with lifetime "Featherweight" 85% Magnesia.

THIS attractive school at Philmont, N.Y., carries enlightened planning right down to its basement. To assure maximum efficiency of its modern heating plant, the planners insulated the boiler and flue with "Featherweight" 85% Magnesia Blocks smoothly coated with K & M Asbestos Cement. The piping is insulated with "Featherweight" 85% Magnesia Sections.

"Featherweight" 85% Magnesia gets high grades for insulating *any* job with temperatures up to 600° F. It has been a distinguished success for more than 60 years —providing economical, lifetime insulation on thousands of applications, including ships and power stations, hospitals and food processing plants, oil refineries and chemical installations.

Because "Featherweight" is inorganic in nature, it won't burn. Its insulating properties are not affected by the expansion and contraction of steam system start-ups and shut-downs, or by alternate wetting and drying. It is economical to buy, economical to apply. In combination with K & M Hy-Temp Insulation it will insulate equipment with temperatures up to 1900° F.

You can depend upon "Featherweight" 85% Magnesia to satisfactorily meet exacting insulation requirements. Ask your plumbing wholesaler for further information, or write us.

Nature made Asbestos...
Keasbey & Mattison has made it
serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

There's a lot we don't know about air filters!

FOR 28 YEARS we've been engineering air filters to do a wide variety of filtering jobs. We've learned plenty from this experience. In fact, we think we know as much about air filtration as the next fellow—maybe more. But still we realize that there's a lot we *don't* know about air filters.

For instance, one thing we admit that we can't do is design a "universal" filter that will answer every filtering requirement. And we don't think anyone else can either. You can't get around the fact that every air filter design involves compromise. No one filter can give you the optimum of all factors such as efficiency, pressure drop, cost, face velocity and dirt-holding capacity.

This is why Air-Maze offers a *wide selection* of filter types, each engineered to provide the maximum performance for a particular combination of operating conditions. Each type has been thoroughly field-proved in many installations throughout the country. Each type is all metal—cleanable—permanent. For complete information, call your nearby Air-Maze representative or write Air-Maze Corporation, 25000 Miles Avenue, Cleveland 28, Ohio.

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SILENCERS
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The Filter Engineers

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GREASE FILTERS

LADISH *Controlled Quality* ASSURES METALLURGICAL SOUNDNESS

SPECTROGRAPHIC ANALYSIS
One of many comprehensive Ladish laboratory test procedures for assuring reliable performance.

TO MARK PROGRESS

Ladish measures the spectrum to verify chemical composition

Metallurgical integrity—is safeguarded at Ladish by unsurpassed laboratory controls. Typical is this advanced electronic direct-reading spectrograph. On this unit as many as 300 determinations have been made in one hour to verify compliance of each mill heat with exacting Ladish specifications and, equally important, to assure the absence of detrimental "tramp" elements. Here is but one indication of the thorough, scientific procedures that assure reliability in every Ladish Controlled Quality fitting.

THE COMPLETE *Controlled Quality* FITTINGS LINE
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LADISH CO.

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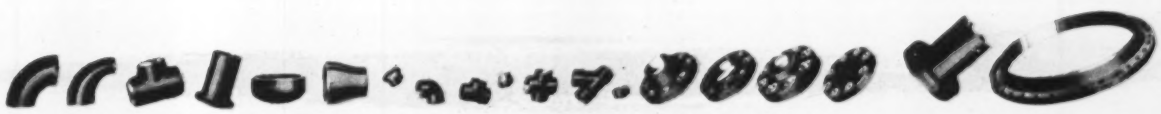

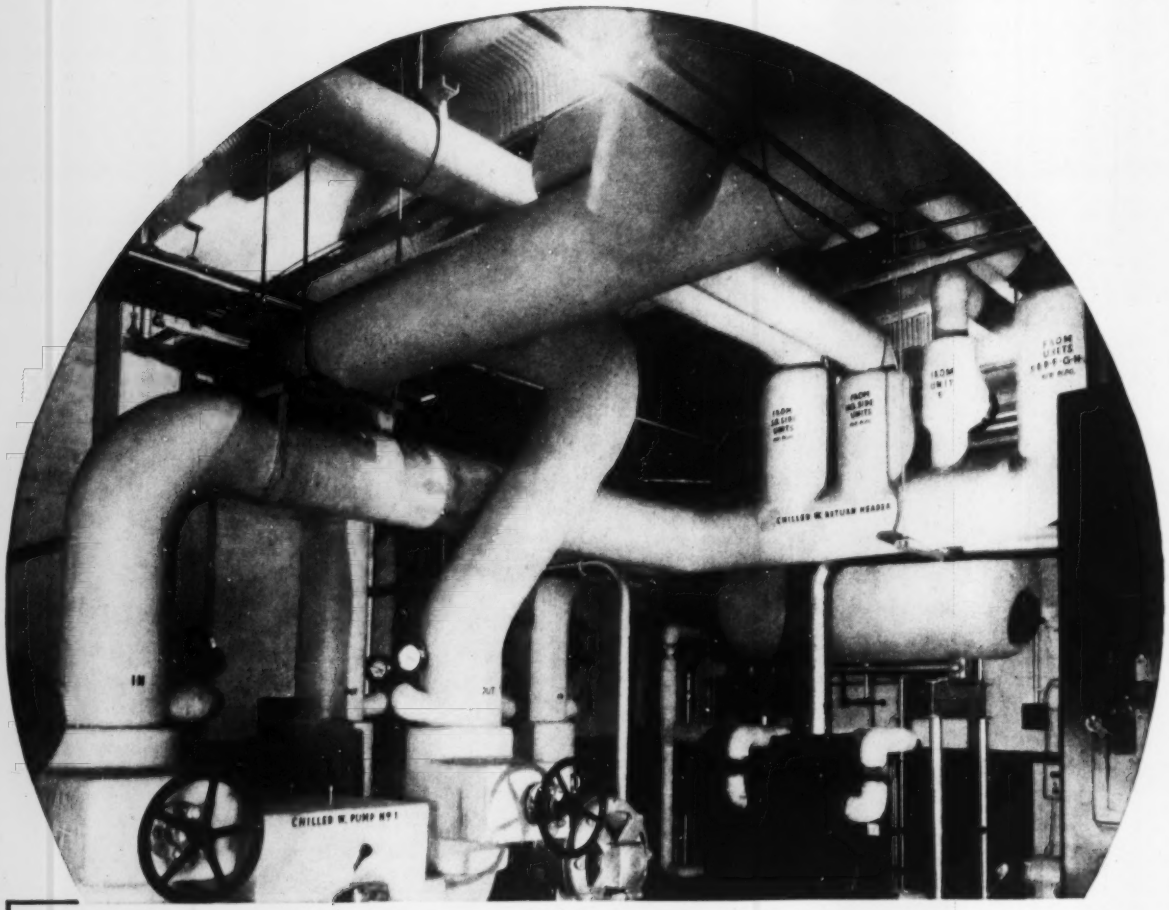

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In Canada:
Mundet Cork & Insulation, Ltd.
35 Booth Avenue, Toronto

Write us for name of our nearest representative if there is no Mundet office in your city.

CORK is the Choice

Here, at the heart of a modern air conditioning system, Mundet Cork Pipe Covering insulates and protects low-temperature pipe lines from heat infiltration. Mundet Cork Pipe Covering is made of 100% pure cork, which, due to its low conductivity, holds power costs to the minimum. Its high efficiency permits precise control of low temperature regardless of climate or season. Cold lines, low temperature ducts, the walls, floors and ceilings of refrigerated rooms should be adequately protected by Mundet Cork Insulation in the form of Cork Pipe Covering and Corkboard. Write for copy of Mundet Cork Manual. Mundet Cork Corporation, Insulation Division, 7101 Tonnelle Avenue, North Bergen, N. J.

MUNDET
CORK INSULATION

CONSERVES LOW-TEMPERATURE

This 7-Letter Word Tells the Story

• There are many descriptive words and phrases we might use to prove the effectiveness of Zallea Stainless Steel Expansion Joints as the ideal medium to absorb thermal expansion and contraction in pipelines. But no single word has more convincing meaning . . . more significance than the simple 7-letter word . . . "*reorder.*"

Over the past 23 years, thousands of industrial organizations have expressed their confidence in our products by reordering not once, *but time and time again!*

Here's a sample of the record:

Company	Number of Orders Placed*	Since
American Viscose Corp.	79	1940
Bethlehem Steel Corp.	51	1935
Carbide & Carbon Chemical Co.	93	1936
Consolidated Edison Co.	115	1933
Dravo Corporation	53	1939
E. I. du Pont de Nemours & Co., (Inc.)	308	1934
Ebasco Services	46	1934
Hercules Powder Co.	133	1937
Koppers Co., Inc.	165	1942
Nordberg Mfg. Co.	174	1942
Sun Oil Co.	60	1938
Texas Co.	261	1938

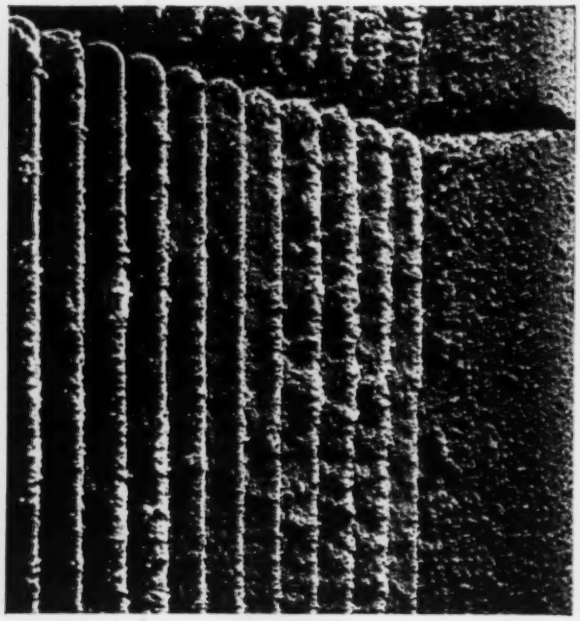
**Including as many as 485 expansion joints in a single order!*

This acceptance is your assurance of the dependable, economical performance you'll receive when you, too, order and *reorder* Zallea Stainless Steel Expansion Joints. Why not write us *today?* Zallea Brothers, 816 Locust Street, Wilmington 99, Del.

Catalog 47 and Bulletin 351 describe the complete line of Zallea Expansion Joints and Flexible Connectors. Write for copies today.

Zallea
EXPANSION JOINTS

Before—PRECIPITRON® cells in close-up show clean aluminum collector plates. This is the way they appear after periodic washings, which dispose of all trapped airborne particles.



After only 2½ weeks cleaning "normal atmospheric" air, the same plates had accumulated this much dirt. PRECIPITRON stops airborne dirt, pollen, mists—even germs and smoke!

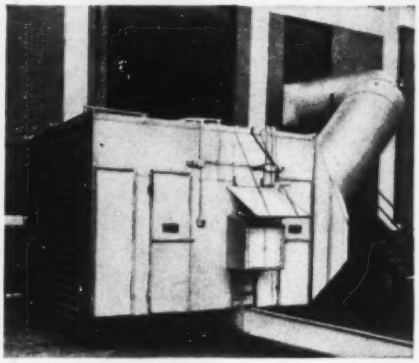
ELECTRONIC BARRIER

AGAINST INVISIBLE DIRT

Airborne particles are costly everywhere. For example, corrosive specks can mar the finished surface of finely machined parts. Contamination is dangerous in laboratories and food processing plants. In textile mills, airborne specks streak the yarns. In processes, buildings, offices—even in homes—"invisible" dirt costs you money.

But PRECIPITRON—the electronic air cleaner—will take *all* the dirt out of the air. It removes particles so tiny they can be seen only with an Ultra Microscope. The savings in controlling airborne dirt with PRECIPITRON are worth looking into today.

To help you *put air to work*—with air cleaning, air conditioning or air handling—Westinghouse offers a complete equipment line. For a free copy of General Catalog 600, call your local Westinghouse-Sturtevant Office. Or, write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

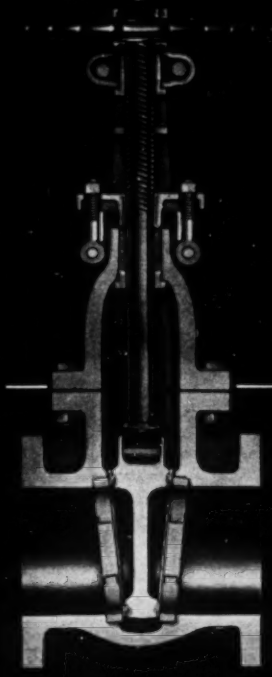


Cleaning efficiency of PRECIPITRON is 90% or better at 333 fpm. Dirt is held on the plates until washed down. A garden-type hose flushes it directly into the drain—quickly, easily, inexpensively.

"YOU CAN BE SURE...IF IT'S **Westinghouse**

AIR CLEANING

J-802278



W

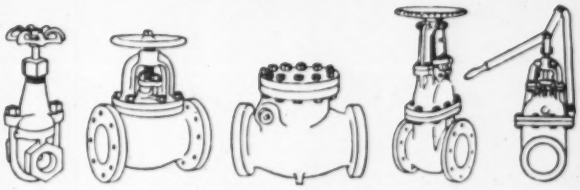
IRON

COMPLETE LINES OF IRON VALVES AND PIPE FITTINGS are manufactured by Walworth in a variety of types, pressure ratings, sizes, and patterns for general industrial use.

Walworth also manufactures complete lines of valves (including Lubricated Plug Valves), and pipe fittings made of steel, bronze, and special alloys.

These valves and pipe fittings, plus Walworth-made pipe wrenches total approximately 50,000 items and are sold through distributors in principal centers throughout the world.

Walworth engineers will be glad to help you with your problems. For further information call your local distributor, nearest Walworth sales office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, New York.



Iron valves in gate, globe, angle, check, and lubricated plug types are manufactured by Walworth. Illustrated is a sectional view of a Walworth No. 726F Standard Iron Body, Bronze Mounted, Wedge Gate Valve with flanged ends. This line of valves is available in sizes 2 to 30 inches. Similar valves of All-Iron type are also available.

WALWORTH

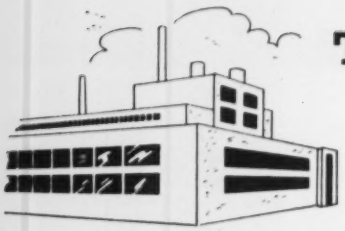
Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

From Small Homes and Offices



To Large Factories and Warehouses

THIS COMPLETE *Airtherm* LINE

Gives Heating Satisfaction on Every Job

GAS FIRED UNIT HEATERS

Efficient answer to heating needs in all kinds of commercial, industrial and public buildings where there is no steam supply. Compact, suspended, propellor fan units available from 25,000 BTU to 200,000 BTU. Write for more information.

STEAM UNIT HEATERS
Horizontal and Vertical Discharge

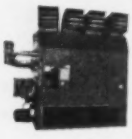
Flexible heating to fit a wide range of requirements in offices, factories, warehouses, stores and public buildings. Horizontal Units available from 18,600 BTU to 270,000 BTU. Vertical Units available from 32,300 BTU to 350,000 BTU. Write for Catalog 1209.

CONVECTORS

Outstanding for easy installation and long, trouble-free service. Clean, uncluttered design blends perfectly into both modern and traditional interiors. Available in a wide range of styles and sizes. Write for Catalog 702-A.

CENTRIFUGAL FAN UNIT HEATERS

Dual Purpose installation for both heating and ventilating can be easily made with this attractively designed unit. Specially desirable for industrial and commercial buildings, schools and auditoriums. Capacities up to 1,440,000 BTU. Available with dampers, filters and non-freeze coils. Write for Catalog 403.



DIRECT FIRED SPACE HEATERS

Self-Contained unit for direct firing with gas or oil or combination gas and oil with instantaneous change over. May be used as both heater and ventilator or heater alone. Comes equipped with motor, burner, heavy-duty combustion chamber, plus all safety devices. Capacities from 650,000 to 2,000,000 BTU. Write for Catalog 802-B.

For Heating Satisfaction...
Think First of
Airtherm

AIRTHERM MANUFACTURING COMPANY
711 South Spring Avenue • St. Louis 10, Missouri

The model BR Diffuser is an adjustable multicone ceiling outlet that embodies modern styling, rigid construction, easy installation and is easily adjustable for all air patterns.

The modern design compliments any interior styling. The three standard neutral finishes, available at no extra cost, will blend and harmonize with any interior color scheme. Special finishes of all types are available on special order.

CARNES

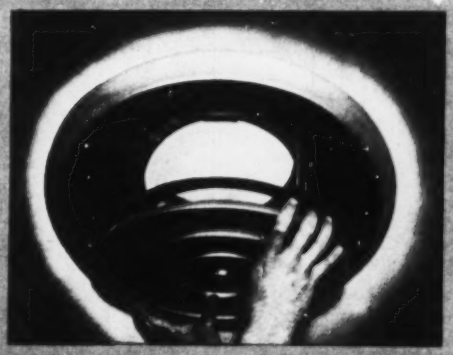
MODEL BR CEILING OUTLET

1. MAXIMUM DIFFUSION EFFICIENCY
2. FOR ALL HEATING AND COOLING SYSTEMS
3. EXTREMELY QUIET OPERATION
4. STURDY CONSTRUCTION
5. COMPLETE RANGE OF SIZES
6. MODERN STYLING
7. ATTRACTIVELY PRICED

EASY TO INSTALL

Easy installation is one of the many unique features of the Model BR Diffuser. The adjustable cone assembly is made as a complete unit, and to remove it from the ceiling plate requires only turning it a few degrees counterclockwise. No tools of any kind are needed, thus avoiding the danger of marring the finished surface.

This feature is very important when balancing the system, as the relative position of the adjustable cones is not disturbed, when the cone assembly is removed to adjust dampers.



BULLETIN NO. 201 GIVES FULL SPECIFICATIONS AND PERFORMANCE DATA. SENT UPON REQUEST.

SIMPLE TO ADJUST

•

NO TOOLS NEEDED

TURNING CENTER PLATE CHANGES AIR PATTERN. ANY DESIRED PATTERN FROM VERTICAL TO HORIZONTAL IS QUICKLY AND EASILY OBTAINED.

JENKINS PRACTICAL PIPING LAYOUT 67

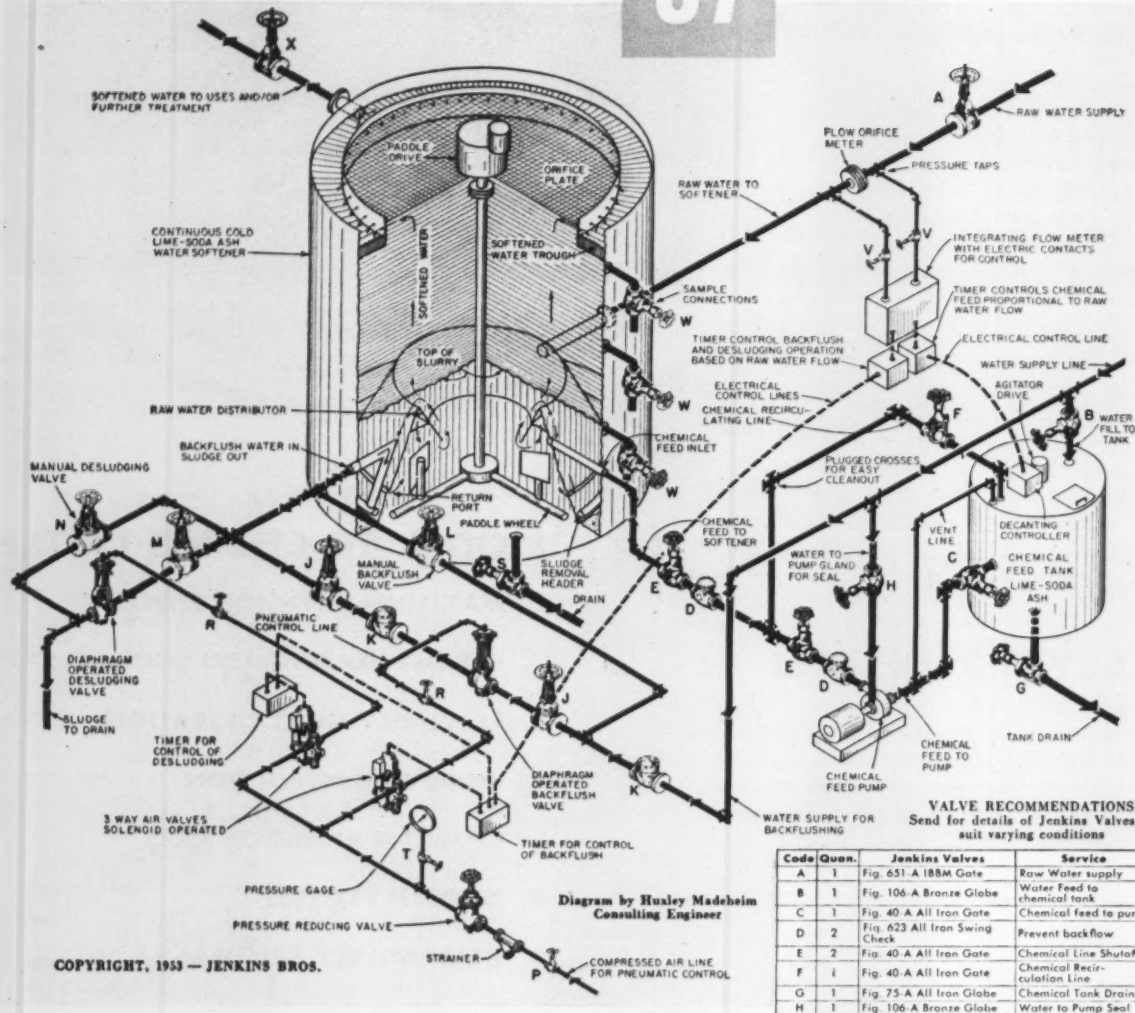


Diagram by Huxley Madeheim Consulting Engineer

COPYRIGHT, 1953 — JENKINS BROS.

VALVE RECOMMENDATIONS
Send for details of Jenkins Valves to suit varying conditions

Code	Quan.	Jenkins Valves	Service
A	1	Fig. 651-A 1BBM Gate	Raw Water supply
B	1	Fig. 106-A Bronze Globe	Water Feed to chemical tank
C	1	Fig. 40-A All Iron Gate	Chemical feed to pump
D	2	Fig. 623 All Iron Swing Check	Prevent backflow
E	2	Fig. 40-A All Iron Gate	Chemical Line Shutoff
F	1	Fig. 40-A All Iron Gate	Chemical Recirculation Line
G	1	Fig. 75-A All Iron Globe	Chemical Tank Drain
H	1	Fig. 106-A Bronze Globe	Water to Pump Seal
J	2	Fig. 651-A 1BBM Gate	Backflush Valve Shutoff
K	2	Fig. 624 1BBM Swing Check	Prevent Backflow
L	1	Fig. 142 1BBM Globe	Manual Backflush Valve
M	1	Fig. 651-A 1BBM Gate	Desludge Valve Shutoff
N	1	Fig. 142 1BBM Globe	Manual Desludge Control
P	1	Fig. 106-A Bronze Globe	Compressed Air Line Shutoff
R	2	Fig. 106-A Bronze Globe	Pneumatic Control Line Shutoffs
S	1	Fig. 100 All Iron Gate	Softener Tank Drain
T	1	Fig. 741-G Bronze Needle	Pressure Gage Control
V	2	Fig. 741-G Bronze Needle	Flowmeter Pressure Tap Shutoffs
W	3	Fig. 75-A All Iron Globe	Sample Takeoffs

How to plan a CONTINUOUS COLD LIME-SODA ASH WATER SOFTENING SYSTEM

A common method of softening water by removing calcium and magnesium salts, the cold lime-soda ash process is now employed in virtually every major industry. Depending on plant requirements, it can be installed to operate as a batch-process or continuous-process system.

The continuous-process system is illustrated. As raw water combines with a lime-soda ash solution pumped from the chemical feed system, microscopic particles form and mix with coagulated precipitate in the tank.

In constant circulation, the mixture of water and precipitate first rises through the mixing zone, then flows down around the outside cone to reenter the mixing zone via a return port. A small portion rises through the slurry to the top and enters the softened water trough for further treatment or use. Larger, denser masses of precipitate drop down to be removed by the desludging system, which automatically loosens up the compacted sludge and drains it off for a predetermined length of time.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of lowest cost in the long run. Jenkins Bros., 100 Park Ave., New York 17.

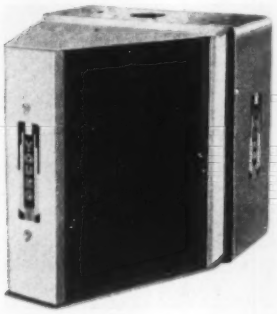
Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 67.

JENKINS VALVES
LOOK FOR THE DIAMOND MARK
SINCE 1864
Jenkins Bros

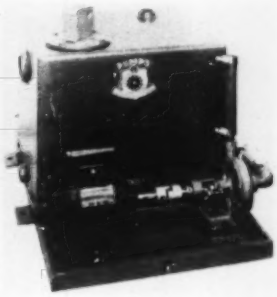
EQUIPMENT DEVELOPMENTS...

Air Cleaner for Heaters

HPAC 1*—"Clean Core" air cleaner assembly for the firm's horizontal unit heaters. . . .It consists of a die-formed filter frame with standard size cleanable air filters. The filters are built in six sizes for 11 models of Type "SH" unit heaters used in hot water or steam heating installations. The entire unit is electric welded and is fastened to the top and bottom of the unit heater casing. [Manufacturer: Young Radiator Co., 709 S. Marquette St., Racine, Wis.]



Cleaner



Pump

Condensate Pump

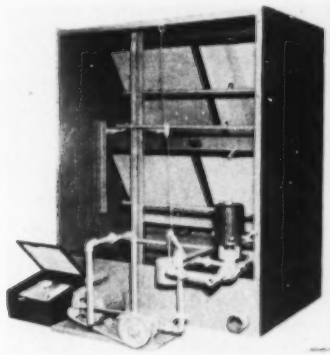
HPAC 2—High capacity condensate pump which requires no pit. . . . According to the manufacturer, the pump does not require a pit even though return pipes are as low as a foot above the ground. It is designed to handle 8000 sq ft of radiation at 20 psi and contains an all bronze centrifugal pump and flexible couplings which isolate the pump from the motor and piping. Power is supplied by a ¼ hp, 115 volt, single phase motor mounted on a drip-lip. [Manufacturer: Walter H. Eagan Co., Inc., 2336 Fairmount Ave., Philadelphia 30.]

Pipe Fitting Indicator

HPAC 3**—"Cassel" pipe fitting indicator No. 253, a drafting template for engineers, designers and draftsmen. . . . The indicator is made to scale and conforms to pipe line graphic standards. According to the manufacturer, it can be used for more than 2000 pipe fitting indications. The template indicates ⅛ in. to 12 in. I.D. pipe fittings in scales of ⅛, ¼ and ½ in. It is recommended for detailing, general layout and designing where double line industrial and commercial pipe line systems are used. [Manufacturer: Graphic Indicator Co., 1739 S. La Cienega Blvd., Los Angeles 35.]

Self-Washing Filter

HPAC 4—Improvements in the "Self-Washing Filter" include the addition of test buttons and a unit to drain water lines. . . .The test buttons enable operation of the



washing and re-oiling mechanism without disturbing the automatic cleaning cycle. The drain unit, which is spring actuated, drains all water lines automatically as a protection against freezing. The units are installed at a 30 degree angle toward the air flow. A series of automati-

For your convenience in obtaining more information about any of this equipment, use this coupon. Add the new products and companies listed here to your Directory Section which you received in your January 1953 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section: double asterisk, equipment and manufacturer not listed.

[6-53]

FOR YOUR CONVENIENCE

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about equipment mentioned under these reference numbers in Equipment Developments.

(Circle each HPAC number in which you are interested)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28

Name _____ Title _____

Company _____

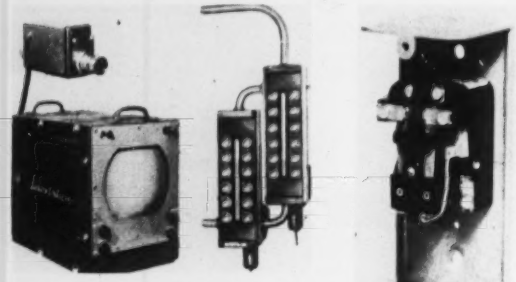
Address _____

City _____ Zone _____ State _____

cally controlled water and oil jets on the entering air side periodically wash and re-oil the filter units. [Manufacturer: Farr Co., P. O. Box 10187, Airport Station, Los Angeles 45.]

Televised Readings of Water Gages

HPAC 5*—Television attachment to pressure sealed flat glass "Yarway" gages bring readings to any convenient place in boiler plant. . . . The television image is transmitted from a small camera to the viewing monitor by a single cable. This two-unit chain is the result of an agreement between the manufacturing firm and the Radio Corporation of America. The special camera base provided furnishes proper lighting of the gage. [Manufacturer: Yarnall-Waring Co., 107 Mermaid Ave., Philadelphia 18.]



Above: Gage
Right: Relay

General Purpose Relays

HPAC 6—Relays to be used as starters for small a-c motors and for electronic equipment and air conditioners. . . . According to the company, the operating life of the new relays has been extended by use of a braided shunt and repositioning of the shunt to reduce tension and wear. The relays, designated as "CR2790-E", are rated from 6 to 300 volts; 60, 50, and 25 cycles plus d-c; and 10 amp continuous contact rating. Contact arrangements include double-pole single-throw, double-pole double-throw, and single-throw double-break. [Manufacturer: General Electric Co., 1 River Rd., Schenectady 5, N. Y.]

Ceiling Mounted Air Conditioner

HPAC 7—Ceiling mounted air conditioning unit with several new features. . . . "Muggy-Air-Control" is designed to remove extra moisture from the air without excessive cooling. The cooling coils have two independent refrigerant circuits, one above the other. A solenoid valve can cut out the upper circuit on high humidity, which reduces the refrigerant temperature and increases the dehumidifying effect. The "Blow-Through" feature places the fan motor assembly in the air intake, exposing it to normal room temperature. The unit also is designed to permit the remote location of the compressor. Models are available in 3 to 10 tons. [Manufacturer: Kramer Trenton Co., N. Olden and Breunig Aves., Trenton 5, N. J.]

By-Pass Valve for Conditioning Units

HPAC 8—By-pass valve, "No. 48 Line," designed for manual control of year-around room-type air conditioning units. . . . The valve permits some circulation in winter, even when the valve is closed, to prevent freezing. In summer when the unit is used for cooling, the by-pass is turned to the closed position to eliminate the danger of excess condensation. The valve has a $\frac{1}{8}$-in. pipe plug outlet for venting or additional by-pass service. It is designed for pressures up to 150 lb and comes in the $\frac{1}{2}$ in. size only. [Manufacturer: Ohio Brass Co., 380 N. Main St., Mansfield, Ohio.]

Valve

Wrench

Automatic Pipe Wrench

HPAC 9**—All-purpose automatic pipe wrench developed by All-Purpose Tool Co. . . . .The wrench operates on a spring principle and adjusts from $\frac{1}{8}$ to $1\frac{1}{4}$ in. The handle is made of solid round steel, the jaw and base of high-carbon alloy-steel and the entire structure is laminated. The teeth are machine-cut and designed to hold pipe with no slipping. [Distributed by: Faver, Inc., 770 S. Second West, Salt Lake City.]

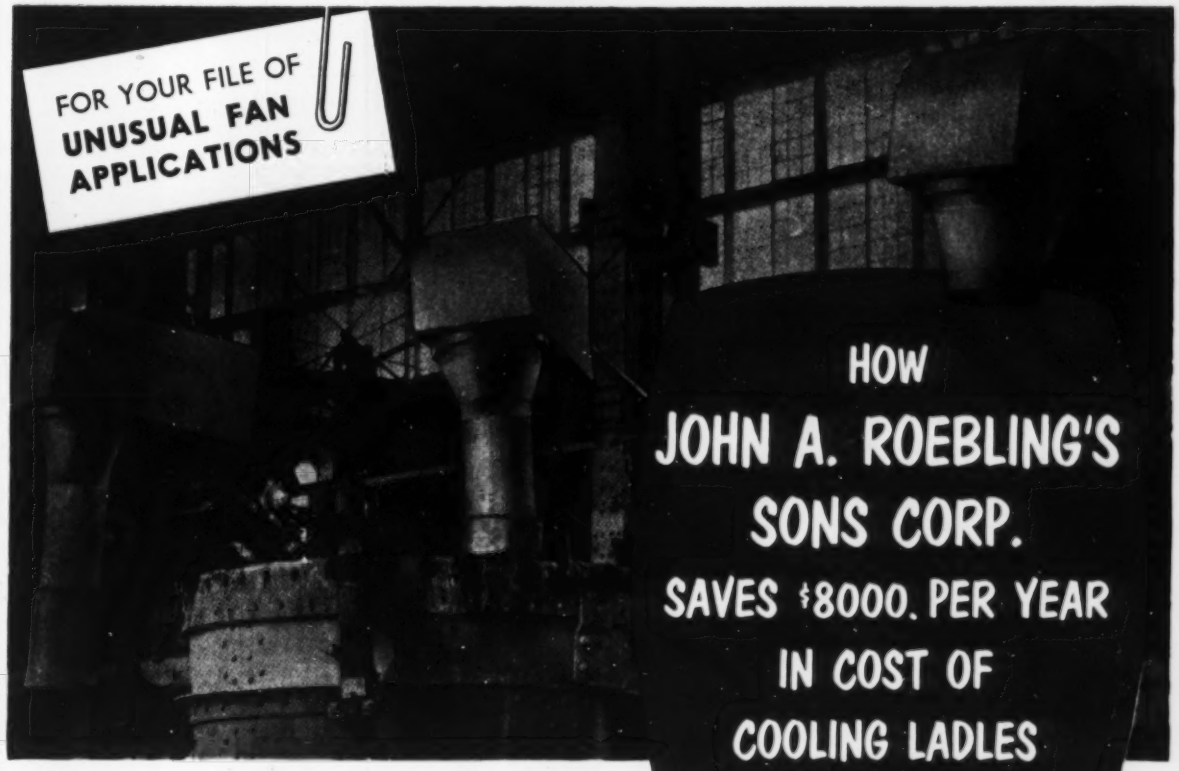
Glass Insulation

HPAC 10—"Duramat" insulation made from glass fiber mat reinforced with parallel strands of glass yarn and coated with a waterproof asphaltic material. . . .The material is recommended for use as a vapor barrier in refrigerated rooms, covering and weather sealing for above ground insulated pipes and exposed ducts and as a lining for ditches, canals, etc. According to the manufacturer, it conforms to ground contour and will not rot or deteriorate. It can be cut with a roofing knife and sealed with a rapid-sealing asphaltic cement. Type 252 has a weight of 51.8 lb per 108 sq ft and Type 251 weighs 23.5 lb per 108 sq ft [Manufacturer: Glass Fibers, Inc., 1810 Madison Ave., Toledo 2, Ohio.]

Coal Gas Detector

HPAC 11—Analyzer and alarm to continuously sample the atmosphere of coal mines for methane gas. . . .Designed primarily for use in mine ventilation systems, the instrument takes samples of return air and automatically analyzes them to detect the presence of methane gas. It can sound an alarm, visible and audible, and may be

FOR YOUR FILE OF
UNUSUAL FAN APPLICATIONS



HOW JOHN A. ROEBLING'S SONS CORP. SAVES $8000. PER YEAR IN COST OF COOLING LADLES

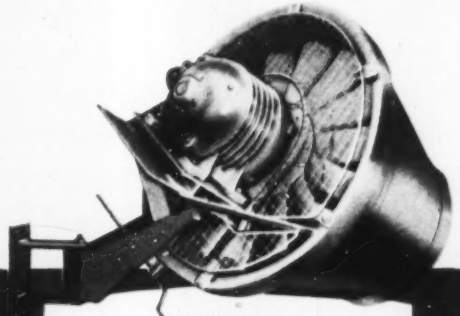
At the Roebling, New Jersey, mill of John A. Roebling's Sons Corporation, seventeen 45-ton ladles are kept busy in the production of carbon steel, from which the famous Roebling wire rope is made. After each heat, ladles must be cooled down from 2000° F and pouring nozzles installed.

Dissatisfied with the old method of using compressed air for cooling ladles, engineers at Roebling's conceived the idea of trying a DeBothezat "Hy-V" Air Jet to do the job. They selected a "Hy-V" Air Jet with 21" fan wheel and 1½ HP motor which produces 5600 CFM at a nozzle velocity of 4570 FPM, and it worked so well that Roebling has installed four more. Each is mounted on a swinging bracket and is equipped with special nozzle extension so that air is discharged near the bottom of the ladle. Nozzle extension is retractable.

Here's what E. M. Yard, Roebling Combustion Engineer, has to say about the installation: *"Nearly the full capacity of one 200 HP air compressor was previously used to do this job. The use of "Hy-V" Air Jets means a power saving of probably $8,000.00 per year. In addition, the installation of these fan units, at a total cost of about $4,000.00 eliminated the need for additional air compressor capacity which would have cost $16,000.00. These fan units will recover their cost in about six months from power savings alone."*

Whether it's a question of cooling people or equipment, "Hy-V" Air Jets do the job efficiently and inexpensively. For detailed information, ask your DeBothezat representative or write our factory, Dept. HP653, for catalog DH-8-51.

Certified Ratings AMA



"HY-V" AIR JET
is a 14-blade axial-flow pressure fan which projects a high velocity stream of air as far as 65 feet. Built with fan wheels 18" through 30" in diameter, with nozzle velocities up to 5780 FPM.

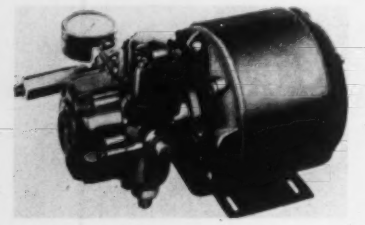
DeBothezat Fans

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

equipped with a device that will provide a continuous written record of methane concentration. In operation, the atmospheric sample flows over a heated platinum wire filament which forms part of a balanced electrical circuit. Any methane present is burned on the wire, causing the circuit to become unbalanced. [Manufacturer: Mine Safety Appliances, 201 N. Braddock Ave., Pittsburgh 8.]

Fuel Oil Supply Pump for Heaters

HPAC 12—"Model 17336" motor-driven fuel oil supply pump for suspended heater installations where high lift and pressure requirements necessitate an auxiliary or supply pump. . . . The manufacturer states it will deliver up to 30 gph maximum with a pressure head of 17 ft above the supply pump when connected on a single pipe



system. It is designed so that any number of overhead heaters may be included in the same system provided that their combined firing rate does not exceed the maximum gallonage. [Manufacturer: Webster Electric Co., Industrial Sales Div., 1900 Clark St., Racine, Wis.]

Plastic Pipe and Fittings

HPAC 13**—Threaded pipe fittings and matching pipes molded of non-plasticized "Boltaron 6200" polyvinyl chloride. . . . Fittings, including tees, elbows and couplings, are carried in stock in sizes ¼ to 2 in. Pipe is available in 10 and 20 ft lengths. According to the manufacturer, this material offers high resistance to organic

and inorganic acids, alkalies, alcohol and foodstuffs. It is said to retain the properties of unmodified polyvinyl chloride including hardness, toughness and rigidity. Company officials claim the insulation value is high and that no condensation forms if the pipe is cold. [Manufacturer: H. N. Hartwell & Son, Inc., Park Square Bldg., Boston.]

Meter Nut Insulation

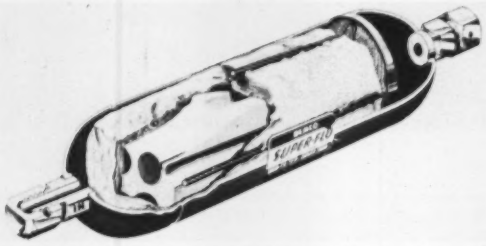
HPAC 14**—Insulating meter nuts and unions of molded nylon to retard electrolytic corrosion in pipe lines. . . . The nut forms a union between the tail piece of the meter and pipe line. The two metal parts in the union are separated by a gas resistant insulating gasket which serves to retain pressure. The meter nut is of molded nylon over which a zinc-plated steel shell is crimped as a container. An opening in the center of the nylon is then machined to proper tap drill size and tapped to the proper thread size. [Manufacturer: Universal Controls Corp., 731 W. Davis St., Dallas, Texas.]

Centrifugal Roof Ventilator

HPAC 15—Centrifugal fan type roof exhauster for air and fume exhaust against static suction. . . . The unit consists of a motor-driven fan in a housing made of heavy gage galvanized iron. Specific types of vertical discharge roof ventilators are designed for foundries, machine shops and other industrial buildings where a considerable amount of oil, dust and fumes is in suspension in the air. According to the company, the exhausters can be used for air exhaust or intake, either with or without duct systems. [Manufacturer: General Blower Co., 8610 Ferris St., Morton Grove, Ill.]

Filter-Drier for Air Conditioning, Refrigeration

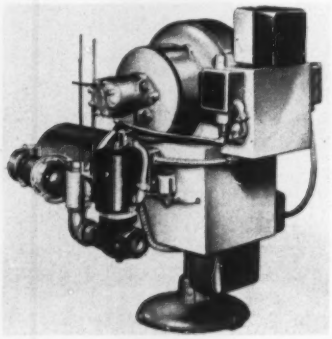
HPAC 16—"Super-Flo" filter-drier for air conditioning and refrigeration systems. . . . The unit consists of a fiber glass depth filter, a molded drying element and a spun-end copper shell. A large fiber glass bag removes the foreign matter in the system and a mesh Dutch weave outlet filter is designed to stop particles larger than 0.0046



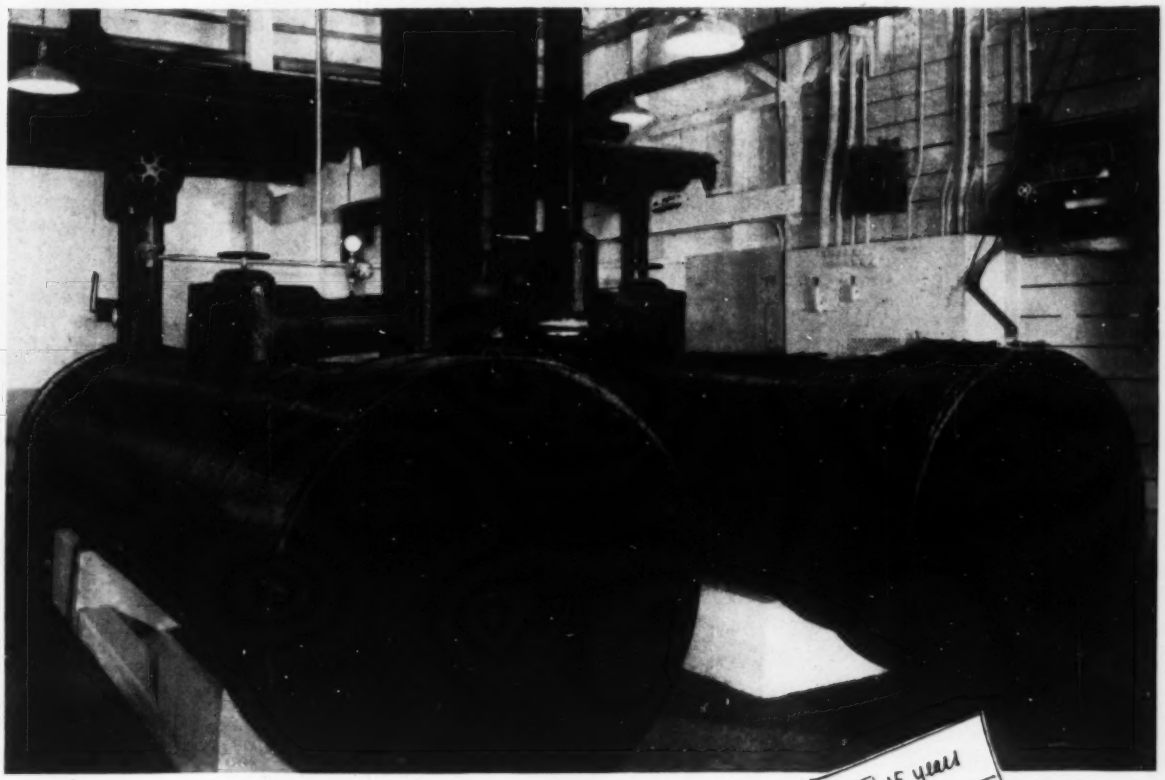
in. The molded "Remcal" drying unit removes moisture both chemically and physically and also removes adsorbing acids. Flow channels permit the refrigerant to flow in direct contact with the drying agent for fast moisture removal. The units are available in sizes up to five tons. [Manufacturer: Remco, Inc., Zelienople, Pa.]

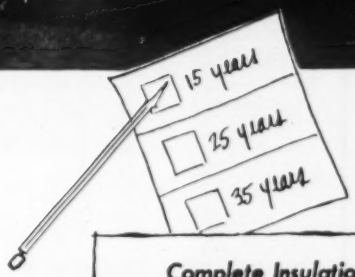
Forced Draft Gas-Oil Burner

HPAC 17—Forced draft gas burner with a gun-type oil burner to provide a packaged unit. . . These units are available in capacities from 100,000 to 3,000,000 Btu per hr using light oils and either natural, mixed or LP gases. Operational sequence includes both pre-purge and post-



purge periods to clear the heating plant for safe operation. Fuel section is automatic by temperature change or by means of a selector switch. All burners, including controls, are factory assembled. According to the company,





How old is the cork insulation on these brine coolers?

Cork insulation, properly installed, will give you a lifetime of service. Here, for example, are brine coolers covered with cork lagging. The cork looks no older than it did the day it was applied. Yet that day was 'way back in 1928.

These coolers are at the Security Warehouse and Cold Storage Co., Santa Clara, California. For 25 years their only maintenance has been a yearly application of Armstrong's No. 1 Asphaltic Paint. Without any other care, the cork insulation has remained dry, tight fitting and is doing its job efficiently. There is no sign of deterioration and every indication points to many more years of trouble-free service.

Long life is an old story with cork. This job is only one of many hundreds where Armstrong's Cork Insulation is still performing at top efficiency after 20, 30, and even 40 years.

Low-temperature insulation, installed with proper attention to details that might affect service life, will pay dividends for many years. That's why so many companies make it a point to call on Armstrong. Armstrong's complete contracting service will do the entire job for you—from specification to application. Behind every job is the reputation of the leader in cork—**Armstrong.** For more information, call your near-by Armstrong office or write Armstrong Cork Company, 2006 Sherman Street, Lancaster, Penna.

Complete Insulation Contract Service

There are many factors that can't be written into an insulation contract, but which can largely determine whether or not the agreement will be entirely satisfactory. They include:

1. Financial responsibility—resources to complete the contract despite any unforeseen events.
2. Integrity—a reputation for quality work and for prompt settlement of any justified complaints.
3. Technical ability — experience, plus technical and research staff to do the job in accordance with best practices.
4. Manpower resources — trained supervisors and workmen able to handle any contract efficiently.
5. Efficiency — ability to deal with problems of accounting, tax provisions, insurance, and workmen's compensation.

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ARMSTRONG'S INDUSTRIAL INSULATIONS

For temperatures from 300° below zero to 2800° F.

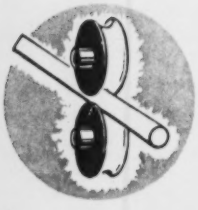
ALL THE PIPING SUPPLIES YOU NEED

At your Finger Tip

Dial your Republic Steel Pipe Distributor's telephone number—when and as often as you wish—and forget about the handling and storage costs, capital investment and inventory losses of trying to maintain stocks of your own.

Your Republic Steel Pipe Distributor carries a full line of pipe in the sizes you need—plus the fittings, valves, fixtures, controls, tools and other items for each complete job. His stockroom is *your* stockroom. From it he delivers just what you need when you need it.

His service is always at your finger tip. Why not get better acquainted with him—and with the high-quality materials he stocks?



Easy to bend, thread and close coil
Easy to weld by all methods
Uniformly ductile
Uniformly strong
Uniformly clean and scale-free
Uniform wall thickness, diameter, concentricity
Economical uniform lengths, extra long lengths

REPUBLIC STEEL

STEEL PIPE

the only connections needed are operating control, power and fuel supply. [Manufacturer: Siemon Mfg. Co., 1817-19 Holmes St., Kansas City 8, Mo.]

Submersible Sump Pump

HPAC 18—Submersible high capacity sump pump. . . . The 1/3 hp "Franklin" 115 volt, 60 cycle a-c motor has sealed ball bearings permanently lubricated, the company states. Sealed stainless steel housing serves as float and

automatic switch control. The unit has built-in automatic overload protection. The operating range is set at the factory. The entire unit is installed below floor level and can be controlled manually by applying tension on the handle. [Manufacturer: Bruner Corp., 2318 N. 30th St., Milwaukee 45.]

Unit Air Conditioner

HPAC 19—Addition of a new three hp size to firm's line of unit air conditioners. . . . Features of the units include insulated condensers and cooling surfaces larger than those ordinarily used, according to the manufacturer. [Manufacturer: Frick Co., Waynesboro, Pa.]

Metal Aligning Flange Gasket

HPAC 20**—"Vic-O-Seal" metal aligning flange gasket designed to prevent leakage due to misalignment. . . . The gaskets are available with O-ring seal or metal to metal fit. According to the manufacturer, they can be used with all standard fittings for fluids, gases and air. [Manufacturer: Vickers, Inc., Div. of the Sperry Corp., 2160 E. Imperial Highway, El Segundo, Calif.]

Vacuum Pump Improvement

HPAC 21—Design improvements in vacuum pump to reduce pump operating and maintenance costs. . . . A new split packing nut in pump water ends is designed to speed and simplify the job of repacking. Smaller horsepower motors now are being used to pull and maintain vacuums up to 26 in., the manufacturer states. A new suction check valve has been added to provide quieter pump operation. [Manufacturer: C. A. Dunham Co., 400 W. Madison St., Chicago 6.]

Refrigerant Drier

HPAC 22*—"T-Flo" refrigerant drier features interchangeability of all size driers and connectors. . . . The new drier, shaped like a "T", is available in 8, 12, 20 and 30 cu in. sizes. Seven sizes of T connectors ranging

ELECTRO
Extra
DYNAMIC
ependable industrial motors

E.D. motors are engineered for *silent* operation with special slot design, dynamic balancing and scientific bearing assembly.

FOR QUIETER OPERATION . . . Over half a century of building motors for "the silent service" to power and air-condition U. S. submarines has given Electro Dynamic an unequalled experience in producing motors for installations where SILENCE is a primary consideration.

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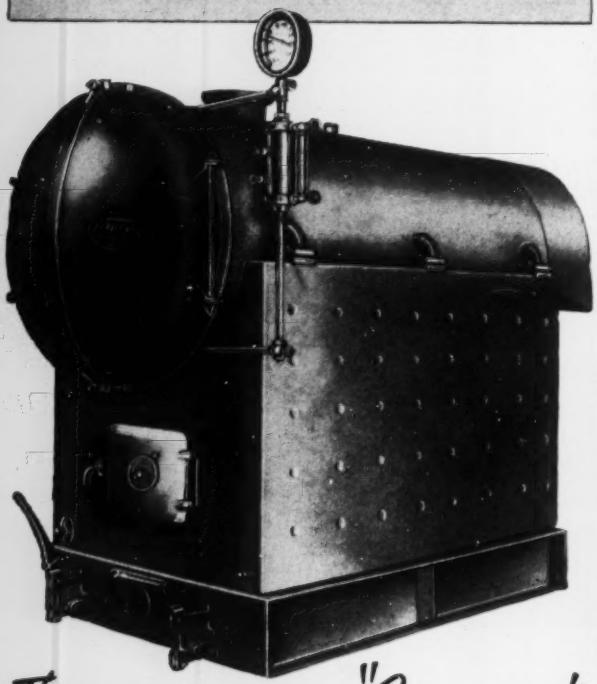
BAYONNE, NEW JERSEY

Your All-Around Boiler

FOR ALL FUELS

AND ALL TYPES OF FIRING



The **TITUSVILLE** *"Compact"*

Steel Heating Boiler

Economical use of oil, gas or coal is an outstanding advantage of the Titusville "Compact" Boiler. An exceptionally large combustion chamber runs the full length of the shell, providing ample space and time for complete burning—yet the boiler takes up less room than any other type. ● Extensive automatic welding of seams and joints, positive circulation, steel flue-door assemblies and other refinements assure trouble-free service.

Write for Bulletin B-3000-B.

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from ¼ to ⅝ in. are provided. The connectors do not have to be removed from the line when changing driers. According to the company, the unit is leak tested with nitrogen at 300 lb pressure and may be hand or wrench tightened. A new desiccant, "An-Drite," is used in the drier. [Manufacturer: Ansul Chemical Co., Refrigeration Div., Marinette, Wis.]

General Purpose Pump

HPAC 23—General purpose pump with new impeller design said to improve priming qualities and increase pump output with the same power. . . . The new impeller has 12 vanes. Sharp lateral wiping edges on each vane are designed to minimize friction by reducing impeller drag, produce less unit wear and improve mechanical efficiency of the pump. The pump is available in ½, ¾ and 1 in. port sizes. [Manufacturer: Hypro Engineering, Inc., 404 N. Washington Ave., Minneapolis 1.]

Cargo Truck for Pipe

HPAC 24—Cargo truck designed for carrying pipe, structural steel and other long, bulky cargo. . . . The truck, which looks like a highway-borne aircraft carrier, has a large steel deck broken by the "island" formed by the cab in the left front corner. The single-axle type has a 25 ft deck length with a turning wheelbase of 14 ft, 11

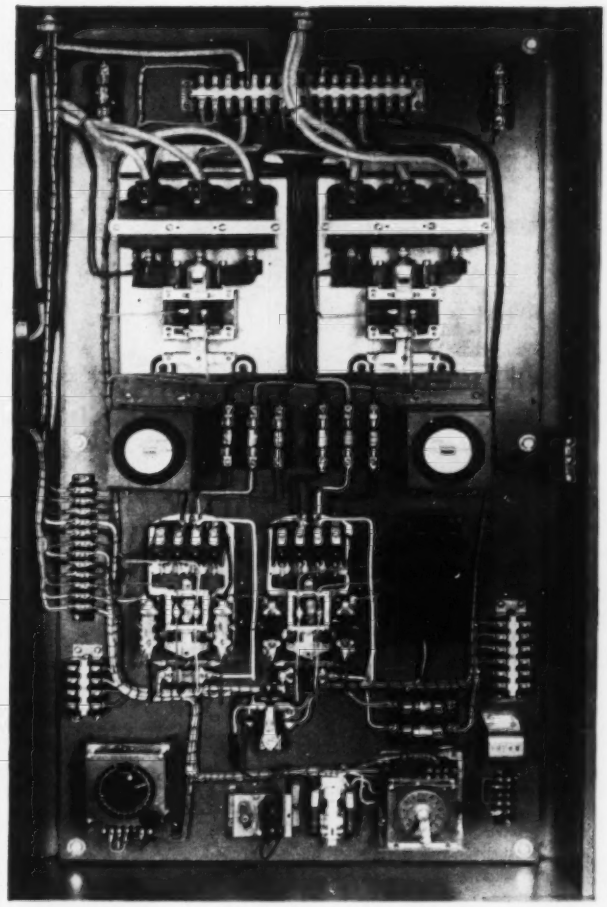
in. The dual-axle has a 30 ft deck and 17 ft wheelbase. Pay loads are 10 tons for the single-axle and 15 tons for the dual-axle. The steel deck plates are mounted over a heavy wood bed which is carried on steel frame rails running the full length of the truck. A 150 hp engine is mounted under the cab. [Manufacturer: Murty Bros., 906 N.E. 3rd Ave., Portland, Ore.]

Arc Welding Head Shield

HPAC 25*—"Comfort Shield," arc welding head shield. . . . A feature of the shield is a pliable head band made of plastic rather than fiber. The band is adjustable to fit both around and over the head and can be put on with one hand. According to the manufacturer, the plastic does not dry out or curl up. The shield itself is made with one-piece molded fiber construction. Adjustable stops on each side of the head band limit the drop of the helmet to any point desired by the welder. The stops are designed to prevent the shield from hitting the nose or chin when welding vertical or overhead. [Manufacturer: The Lincoln Electric Co., 22801 St. Clair Ave., Cleveland 17.]

Steel Fittings

HPAC 26—"Featherlite," stainless forged steel fittings for industry. . . .The fittings, both screwed and socket-



INTERIOR OF CONTROL PANEL shows two Ward Leonard three-pole contactors (near top of photo) and two motor starters (lower half of photo).

Dehumidifier controlled by Ward Leonard contactors and starters

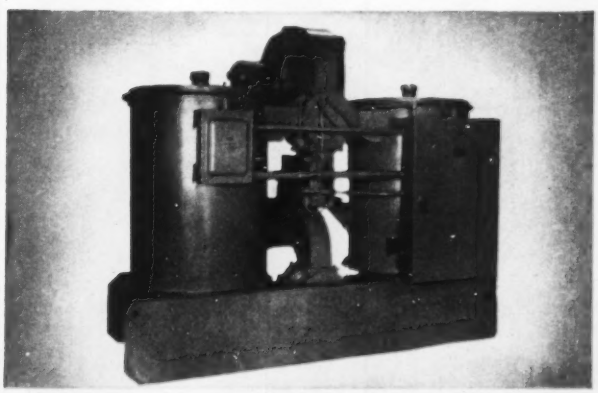
Two Ward Leonard three-pole solenoid contactors and across-the-line starters are an integral part of the control panel of the Desomatic Model DOR-800 Adsorbent Dehumidifier.

Daly, Merritt & Sullivan of Falls Church, Virginia, who manufacture the dehumidifier, needed electrical control components that could be readily installed in a custom control assembly.

The Ward Leonard contactors and starters which they selected fit this requirement because both are self-contained units . . . this results in simplified assembly, fast mounting and easy wiring.

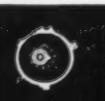
Whatever the electrical requirements of your product, our engineers will be glad to help you select dependable controls to meet them. Write to Ward Leonard Electric Company, 24 South Street, Mt. Vernon, N. Y.

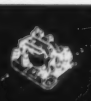
3-35



DESOMATIC DEHUMIDIFIER is used for preservation of equipment during long storage in warehouse buildings.

WARD LEONARD ELECTRIC COMPANY
MOUNT VERNON, NEW YORK


RHEOSTATS


RELAYS

RESISTORS

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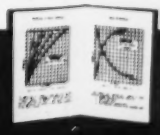
Result-Engineered Controls Since 1892


Ward Leonard's complete engineering text book, "Handbook of Power Resistors," $3 per copy.

Unaffected even after weeks under water*

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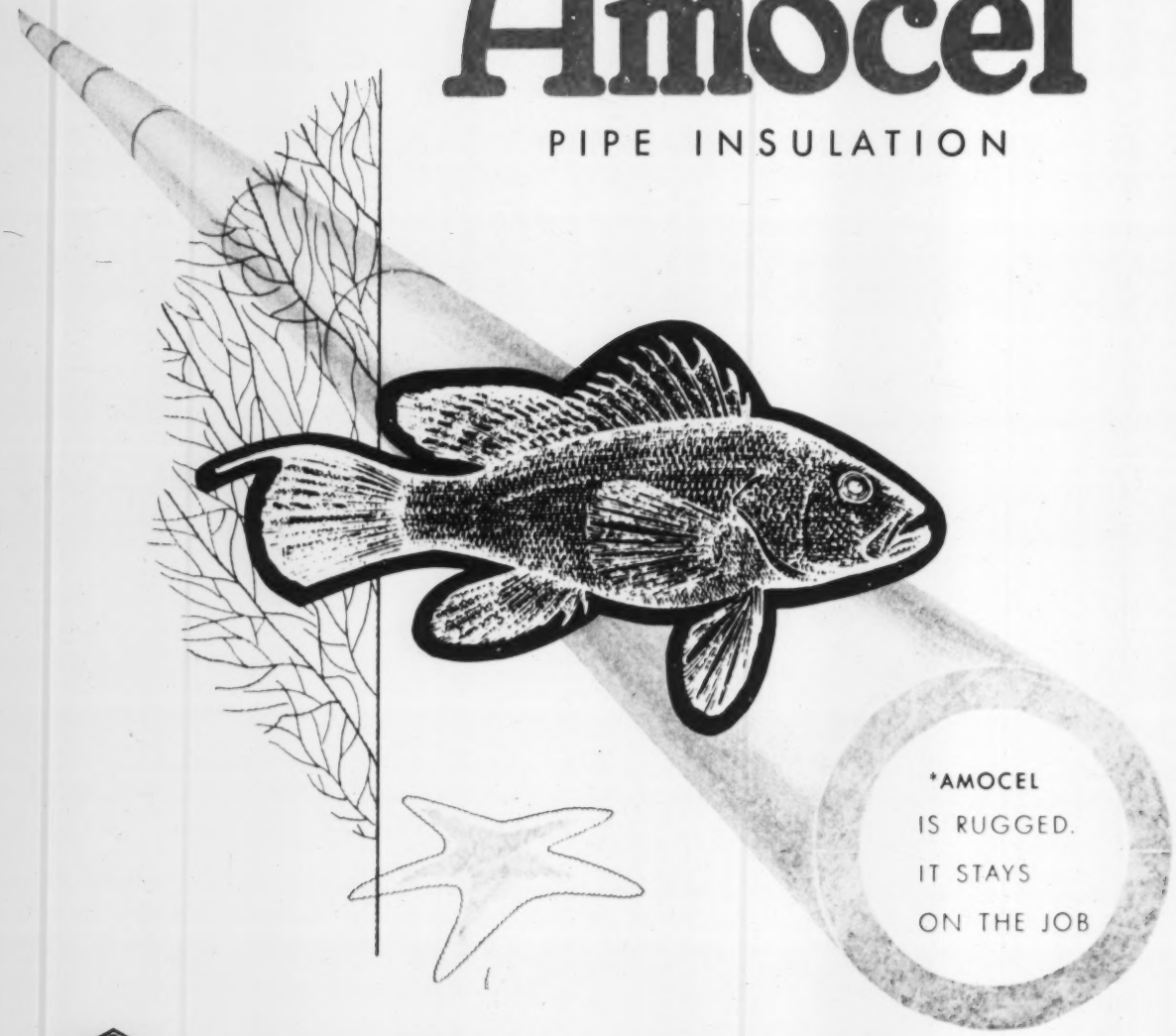

*AMOCEL IS RUGGED. IT STAYS ON THE JOB

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Jamar-Olmen Construction Company
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Throughout the Kansas City trading area, Jamar-Olmen Construction Company serves the whole field of industrial and commercial insulation.

Ample warehouse stocks of Unibestos, Amocel, and other Unarco quality products assure prompt service, and Jamar-Olmen engineering assistance is always available for suggestions and recommendations.

For information . . . for estimates . . . for from-stock deliveries . . . phone Jamar-Olmen. The Kansas City number is HArrison 2835. Or, if you are located in the vicinity of Omaha, Neb., phone the Rosborough Fire Brick and Supply Company, KEnwood 4492.

INDUSTRIAL Insulations

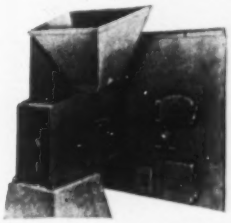
PRODUCTS OF

UNION ASBESTOS & RUBBER COMPANY

welding, are available in Types 304 and 316 stainless steel. The screw type features uniform wall thickness and accurately cut threads for alignment, the manufacturer states. The welding type has a deep socket to support and align pipe. Both are bored from solid drop forgings. Available in sizes from $\frac{1}{8}$ to 1 in., the fittings include elbows, tees, ells, crosses, couplings, caps, plugs and bushings. [Manufacturer: Watson-Stillman Fittings Div., H. K. Porter Co., Inc., 140 Aldene Rd, Roselle, N.J.]

Underfeed Stoker

HPAC 27—"Fluid-Ram" hydraulically driven and controlled single retort underfeed stoker. . . .According to the company, the stoker provides unobstructed access to fire doors, sift-doors and ashpit doors. The hydraulic fuel feed control is designed to offer a wide range of fuel



regulation, making the unit suitable for automatic combustion control where wide load range operation is desired. [Manufacturer: Erie City Iron Works, 1150 East Ave., Erie, Pa.]

Pipe Stand

HPAC 28*—The problem of obtaining a neat piping installation for steam heated process machinery is simplified by a newly designed, triple-deck pipe stand. . . . .This new pipe stand is adjustable to allow for floor misalignment and can also be adjusted to give steam, return and air line piping the proper gravity pitch. According to the manufacturer, its use permits convenient location of valves and fittings, making maintenance repairs or adjustments easier. [Manufacturer: Fred H. Schaub Engineering Co., 2110 S. Marshall Blvd., Chicago 23.]

EQUIPMENT BRIEFS . . .

AUTOMATIC THERMOSTAT that keeps an air conditioned room at the desired temperature level. Available as an accessory for use on the company's 1/3, $\frac{1}{2}$, $\frac{3}{4}$ and 1 hp units, the thermostat is designed to maintain an even degree of cooling by controlling the compressor power unit. [Manufacturer: Mitchell Mfg. Co., 2525 N. Clybourn Ave., Chicago.]

SELF CLEANING DRILL tipped with tungsten carbide for boring holes in concrete, brick, plaster and other materials. A newly-designed spiral flute automatically lifts dust out of the hole as it rotates. [Manufacturer: General Electric Co., Carboloy Div., Detroit.]

SPECIAL PURPOSE GUARDS for the firm's Model 450 stud driver. Designed for anchoring of special sections or fixtures to steel or concrete, the guards are made to conform to the shape of the prefabricated sections. Each of the special guards can be rotated 360 degrees. Included in the new line are guards for fastening conduit clips, structural angle and channel, plywood carpet gripper and lathing channel. [Manufacturer: Remington Arms Co., Inc., Bridgeport, Conn.]

When it's a call for a **FORCED AIR FURNACE...**

There are 3 ways you can profit more with bryant

1. *You can profit more on the initial sale!* All Bryant Forced Air Units are available to you at attractively low, margin-boosting prices.

2. *You can make an extra profit!* Today, many furnace sales present an opportunity to sell air conditioning as well. There are two Bryant lines of central cooling units—vertical and horizontal—to satisfy your need for a broad range of products that meet all requirements of cooling, space and price. It's a single source of supply for the complete job. And you can sell this broad line for installation with all Bryant Forced Air Furnaces—a most practical and positive profit opportunity for you.

3. *You can maintain your profit!* Bryant is famous for quality—and good quality means decidedly fewer, profit-shrinking "call-backs".

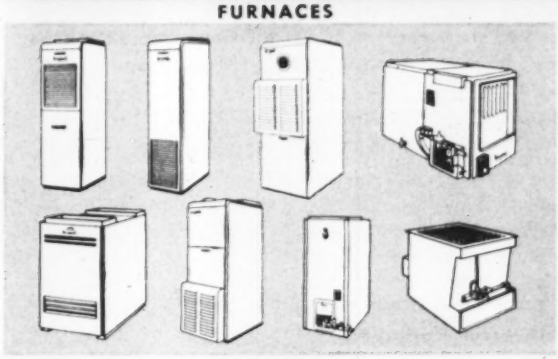
And Bryant helps you sell! To strongly supplement Bryant's extensive national advertising program, Bryant heating and air conditioning literature will be sent to over 80,000 families definitely known to be building new homes within the next 12 months. Names of these families in your area will be supplied to you—another reason to investigate this handsome, 3-way profit opportunity today.

Contact your nearby Bryant distributor for complete information or simply write: Bryant Heater Division, 17825 St. Clair Avenue, Cleveland 10, Ohio.

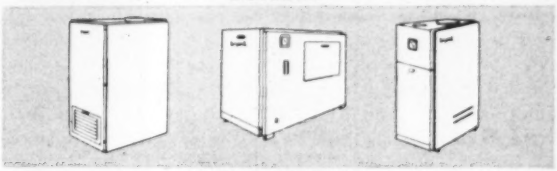
Profit with the name that everybody knows...

THE MOST COMPLETE LINE OF HOME CONDITIONING EQUIPMENT IN THE INDUSTRY

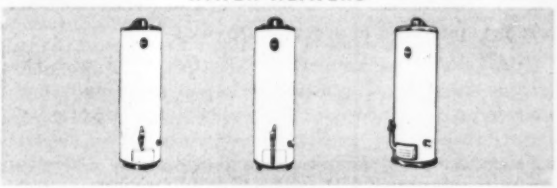
FURNACES



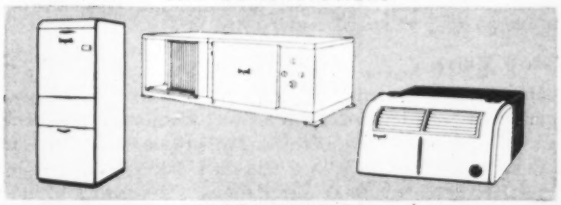
BOILERS



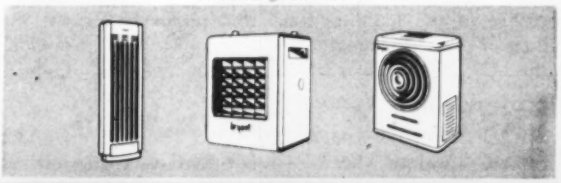
WATER HEATERS



AIR CONDITIONERS



SPACE HEATERS



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RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on this page. If you write direct to the manufacturer, describe fully what you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

FOR YOUR CONVENIENCE [6-53]

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6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me the publications mentioned under these reference numbers in Recent Trade Literature:

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114 115 116 118 119 120 121 122 123 124 125 126
127 128 129 130 131 132 133 134

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

Acoustic Ceilings

HPAC 101—This brochure describes the process of installing "Acusti-Luminus" ceilings. This method is designed to provide diffusion of room illumination over the entire ceiling area. At the same time, the use of acoustical baffles gives the room acoustical correction. The booklet shows photographs of actual installations, drawings of ceiling construction and gives installation instructions. According to the manufacturer, the use of a plenum chamber above the ceiling as an expansion chamber, creates proper air diffusion and eliminates the use of ducts in air conditioning. [Manufacturer: Luminous Ceilings, Inc., 2500 W. North Ave., Chicago 47.]

Air Conditioner Data

HPAC 102—Bulletin 522-C shows typical installations of the company's line of unit air conditioners. A cutaway photograph explains the details of operation. Installation instructions also are given. [Manufacturer: Frick Co., Waynesboro, Pa.]

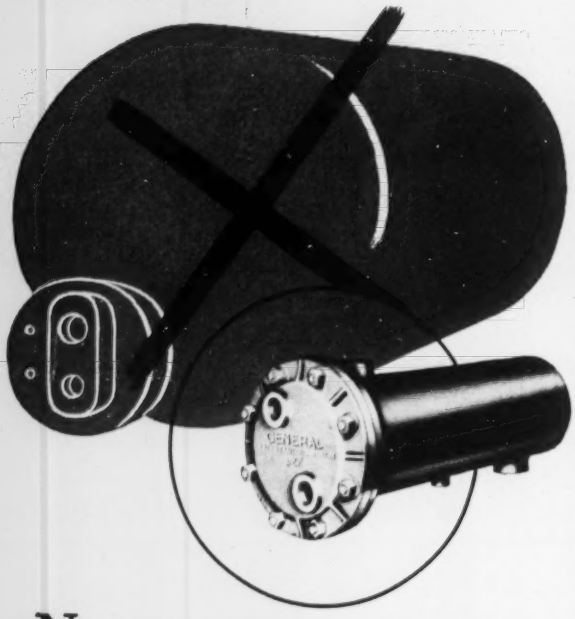
Air Conditioner

HPAC 103—Data book on "Capillary" unit conditioners is the first section of a complete catalog being prepared by the company on its various products. This first section contains complete basic engineering data and physical data on the air conditioner. Complete specifications, performance charts, dimensions and schematic drawings are included. Selection tables are given and typical arrangements are fully described. [Manufacturer: Air & Refrigeration Corp., 475 Fifth Ave., New York 17.]

Blast Cleaning Hose Machines

HPAC 104—Bulletin 110A describes the blast cleaning hose machines produced for industry's hand-operated cleaning jobs. The direct pressure and suction methods of

Heat Water the Modern Way ...without a tank



NOW YOU CAN HAVE a continuous hot water supply without installing a bulky storage system. General Instantaneous Water Heaters supply hot water as it is needed, and require a minimum of space. The largest model delivers 300 gpm and measures less than 2 ft. x 7 ft.

Installation is simple . . . whether on the floor or overhead. Merely tap the General Instantaneous Heater into your service line and connect a live or exhaust steam supply for heat source. Periodic maintenance is eliminated. Seamless copper tubing and bronze head and tube plates assure years of "clean" hot water supply.

You'll find a model to fit your needs among 21 sizes of General Instantaneous Water Heaters. Write for Catalog 60. General Fittings Co., Dept. A, 123 Georgia Ave., Providence 5, R. I.

applying the abrasive are discussed. Tables are given which show the relationship between orifice area and circumference in nozzle sizes and air flow with required horsepower to develop air jets of varying diameters. [Manufacturer: Pangborn Corp., 400 Pangborn Blvd., Hagerstown, Md.]

Centrifugal Pumps

HPAC 105—Folder No. CSP-453 is a list price sheet for the company's centrifugal pumps which now can be ordered from stock. Various selection charts show capacities, prices and dimensions. [Manufacturer: Bell & Gossett Co., Morton Grove, Ill.]

Compressors for Air and Gas

HPAC 106—Bulletin 546 briefly describes the firm's line of air and gas compressors, dry vacuum pumps, aftercoolers, "Airchek" valves and centrifugal pumps for boiler feeding, general power plant and industrial applications. The six-page catalog contains pictures of each item with a description, capacities and sizes. [Manufacturer: Pennsylvania Pump and Compressor Co., Easton, Pa.]

Convector Radiation

HPAC 107—Bulletin 1201 describes the firm's line of redesigned cabinet convectors for commercial, industrial, institutional and residential buildings. Eight cabinet styles are illustrated, each with dimensioned drawings. The bulletin also includes steam and hot water capacity tables for 10 deg and 20 deg drop, plus conversion factors. Example calculations show how the tables are used to select the correct convector. [Manufacturer: C. A. Dunham Co., 400 W. Madison St., Chicago 6.]

Current Actuated Protective Devices

HPAC 108—*Do Your Protective Devices Really Protect?* is the title of a new booklet on checking current actuated protective devices. Described are overload relays, circuit breakers, etc. and step by step instructions for testing and calibrating them in the field are given. A description of the "Industrial Multi-Amp" used to check these devices is included. [Manufacturer: Multi-Amp Corp., Harrison, N. J.]

Cutoff Valve

HPAC 109—Bulletin 7300 contains specifications of the firm's positive pressure cutoff valve. Originally designed to prevent runaway pressures in low pressure distribution systems, it is applicable as a service cutoff valve on large industrial or commercial installations. According to the manufacturer, it will prevent an excessive build up of pressure in the building lines that might be caused by failure of the service regulator. [Manufacturer: Norwalk Valve Co., 33 Railroad Ave., South Norwalk, Conn.]

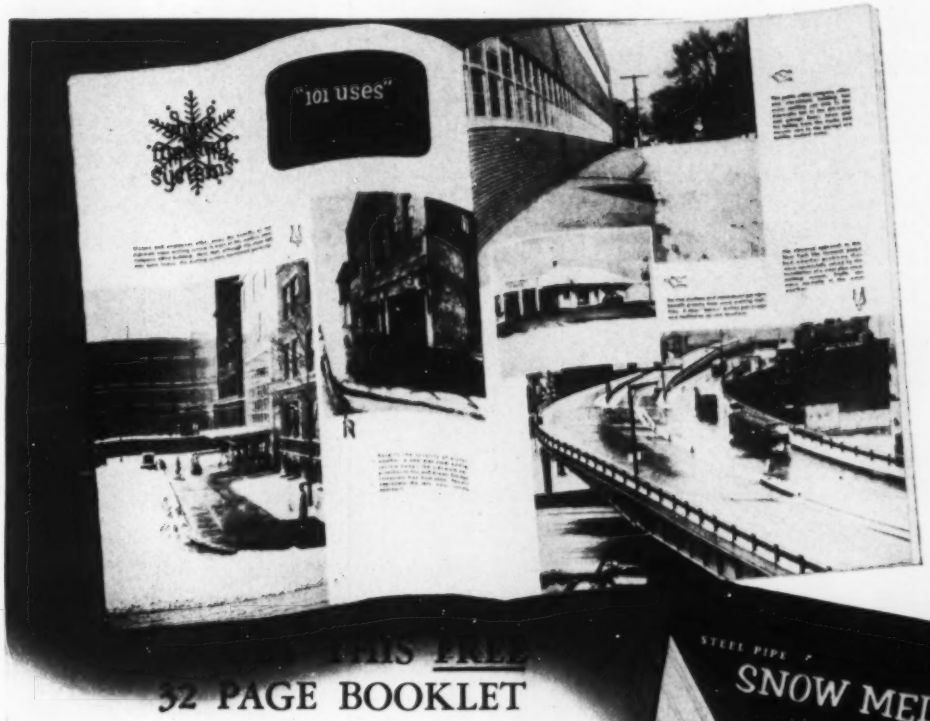
Electrical Wiring Conduit

HPAC 110—Four-page illustrated Bulletin UA-530 describes "Sealtite" flexible liquid-tight electrical wiring conduit. The conduit is designed to protect wiring against moisture, dirt, chemicals and corrosive fumes. Suggested applications and specifications are included. [Manufacturer: American Brass Co., American Metal Hose Branch, 692 Main St., Waterbury, Conn.]

Industrial Controls

HPAC 111—Catalog 8305 describes and illustrates non-indicating electric, electronic and pneumatic controllers

Cash in on the big, new market for snow melting systems



FREE 32 PAGE BOOKLET

The tremendous public interest in the benefits of snow melting systems now extends the frontiers of the plumbing and heating business to embrace a great, new multi-million dollar market annually.

This is *new* business . . . business that never existed before . . . business that proves that a saturation point is far from being reached!

To give you a better picture of the scope of this profitable new market, the Committee on Steel Pipe Research has prepared an attractive and easily understood booklet for anyone interested in snow melting.

It answers the most commonly asked questions about snow melting systems, suggests applications for domestic, commercial and industrial uses. It covers such important subjects as design, steel piping layouts, temperature requirements, boiler capacities, auxiliary equipment, and step-by-step installation methods.

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AIR CONDITIONING AT ITS BEST!

Central Presbyterian Church

JACKSON, MISSISSIPPI

APPLICATION: Two DOLE *ICE-CEL* units, with a combined capacity of 192 ton hours, are hooked up with one 15 H.P. compressor.

LOAD: 75 tons an hour for two hours, or 150 ton hours — 40 ton hours in excess of requirements, which can be utilized with compressor input for special occasions.

DOLE *ICE-CEL* units are available for low cost installation in churches, halls, mortuaries, offices, retail stores and cafeterias. . .

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MANUFACTURERS OF

THE *ICE-CEL* LINE

for temperature, pressure and humidity, pneumatic and electric valves, switches and relays. Specifications, dimension drawings, application data and ordering information are included. [Manufacturer: Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Station 64, Philadelphia 41.]

Industrial Heater Catalog

HPAC 112—Catalog 1510 gives complete information on standard and heavy-duty centrifugal fan industrial heaters. Information on where to use the heaters, at what circulating capacities and temperatures and how to place them, is given in the application section. Another section explains automatic temperature control and tells how to estimate the heat load a particular heater must carry. As an aid to selection, a set of specifications is given and typical examples are worked out. Also tables and graphs of performance data are given as well as outline dimensions of the units. Other sections cover construction features, accessories and instructions for installation. [Manufacturer: Westinghouse Electric Corp., Sturtevant Div., Dept. T-025, 200 Readville St., Hyde Park, Boston 36.]

Industrial Ventilation

HPAC 113—*Balanced Industrial Ventilation* covers the problems resulting from the relationship of exhaust and make up air systems, and the bearing it has on the heating load. Diagrammatic drawings show the operation of the systems. [Publisher: National Association of Fan Manufacturers, 2159 Guardian Building, Detroit 26.]

Liquid Level Control

HPAC 114—A single-thyratron electronic liquid level control operating without radio frequency from a single capacitive type probe is described in Folder Form LL1-453. This brochure illustrates the single-unit control, the probe and alternative schematic arrangements for installation. Specifications are included. [Manufacturer: Thermo Instruments Co., 1166 El Camino Real, Belmont, Calif.]

Magnetically Driven Centrifugal Pump

HPAC 115—Bulletin No. G 1000 describes a new magnetically driven combined motor and centrifugal pump. The manufacturer states that it requires no mechanical seals or stuffing boxes. The four-page bulletin contains information covering application of the pump and its construction. Also included are dimension drawings, vacuum performance charts and performance curves for all models. [Manufacturer: Chempump Corp., 1300 E. Mermaid Lane, Station "A", Philadelphia 18.]

Non-Metallic Disc Valves

HPAC 116—Circular 558 describes the dimensions and functions of non-metallic disc valves. Listed in detail are the "NMD" valves which can be renewed or converted to handle another type of service by the insertion of a specifically designed composition disc. The discs are made in three special purpose types: for handling saturated steam; for cold water, air and gas; and for gasoline, oil, butane and propane. [Manufacturer: The Lunkenheimer Co., Box 360-U Cincinnati 14, Ohio.]

Oil Equipment

HPAC 117—A new catalog, *Design Makes the Difference*, now is being sent out to distributors and wholesalers.

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SPECIFICATION

and

BUYING INFORMATION

Use your complete, up-to-date

JANUARY DIRECTORY ISSUE

Your job will be a lot easier if you'll keep the January Directory issue of Heating, Piping & Air Conditioning constantly available for handy reference. It's one of your most valuable tools — one which will save you many hours of looking up the products you need for your various jobs. It's the ONE complete, up-to-date, readily accessible source of product information on who makes the pumps, valves, traps, compressors, specialties of all kinds, etc., you need — and where they're located. They're identified by trade names, too. EVERY product is listed, alphabetically arranged and printed on a distinctive yellow stock for easy reading and reference.

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Lo-BLAST Economite Gas Conversion Burner

LO-BLAST

POWER-TYPE GAS CONVERSION BURNER

CAPACITIES 70,000 TO 20,000,000 BTU INPUT

Regardless of the size of the heating plant, Lo-BLAST Gas Burners deliver more heat per fuel dollar. In 19 years of actual operation, these power-type units have consistently cut fuel and service costs.

Because primary and secondary air is perfectly controlled from a blower source, the Lo-BLAST Burner is independent of variable natural draft. Hence it is particularly well suited for down-draft boilers. Combustion is completed in an incandescent firebox, with radiant heat applied to crown sheet as well as side walls.

Other features include soft, quiet flame . . . standard controls with positive acting pilot and blower safetys . . . sturdy, fool-proof design . . . easy to install because completely assembled and factory-tested on gas . . . competitively priced.

A Lo-BLAST dealership is profitable! Complete range of capacities and a nation-wide reputation for economy make this burner a strong seller. Write for information.

The standard Lo-BLAST Gas Conversion Burner

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

This catalog is available to all wholesalers, although dealers may order them if the name of their distributor is included with their request. [Manufacturer: Oil Equipment Mfg. Co., 169 Derby Ave., New Haven, Conn.]

Overhead Heating Unit

HPAC 118—Several pieces of literature, a brochure, catalog and specification sheet, are available describing the "Overhead Panelray," vented infrared ray commercial heating unit. The new literature contains detailed specifications, diagrams, photographs, dimensions and engineering data as well as installation views and case studies. [Manufacturer: Affiliated Gas Equipment, Inc., Day & Night Div., 800 Royal Oaks, Monrovia, Calif.]

Pneumatic Ejectors

HPAC 119—Manual 4000-C contains engineering data on the firm's line of mechanically and electrically controlled "Shone" pneumatic ejectors. Included are curves, tables and suggestions for determining head and capacity requirements; comparative advantages of both mechanically and electrically controlled units; selection charts; design drawings; suggested piping diagrams, and air demand, compressor and air storage information and diagrams. [Manufacturer: Yeomans Bros. Co., 1999 N. Ruby St., Melrose Park, Ill.]

Polyester Film Protects Insulation

HPAC 120—Technical bulletin 1-2-53 contains the latest information on the physical, electrical and chemical properties of "Mylar" polyester film, and suggested applications. In electrical applications, it is used as a slot liner and phase insulation in motors and tape insulation for motor and generator field coils. A non-electrical application suggested is its use as a protective wrap on pipe line insulation such as fiber glass, cork, magnesia, etc. [Manufacturer: E. I. Du Pont De Nemours & Co., Film Dept.'s Sales Development and Technical Service Section, Wilmington 98, Del.]

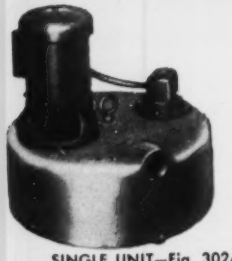
Roll Surface Temperature Control

HPAC 121—*Tomorrow's Roll Surface Temperature Control and New Fress Heating Systems* is a reprint of an address delivered by Paul Geiringer of the American Hydrotherm Corp. at the 1953 Technical Conference of the Society of Plastic Engineers. It discusses the latest developments in the heating and cooling of plastics calenders and presses by means of high temperature water. Also a new indirect method of measuring and controlling roll surface temperature is described. [Reprinted by: American Hydrotherm Corp., 33-70 12th St., Long Island City 6, N.Y.]

Scale Drawings of Gearmotors

HPAC 122—Scale drawings of the company's "Syncrogear" line now are available to layout draftsmen, designers, engineers and architects. Drawn in a simplified style, but to exact scale, these drawings are designed to be inserted under a layout of a machine or other equipment and traced in the proper size and position. Three views are included of each of the 30 motors shown. To aid in the selection of the proper motor, a booklet of specifications, dimensions, shipping weights, etc., is sent with the drawings. [Manufacturer: U.S. Electrical Motors Inc., Terminal Annex, Box 2058, Los Angeles 54.]

LOW PRESSURE SYSTEM *Condensate Pumps*

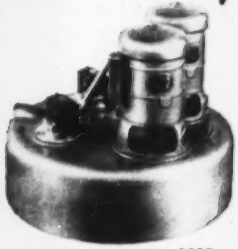


SINGLE UNIT—Fig. 302A
10 Gal. Receiver for Single Units
Diameter 21"
Hgt. of Return above floor 6⅞"

Capacities 500 to 10,000 sq. ft. E.D.R.

weil TVC PUMP

LOW RETURN CONNECTION
LOW SPEED, LONG LIFE
CAST IRON RECEIVER
LOW WATER LINE
ELECTRODE OR FLOAT SWITCH CONTROL



DUPLEX UNIT—Fig. 303B
15 Gal. Receiver for Single or Duplex Units
Diameter 25½"
Hgt. of Return above floor 7⅜"

TVC SELECTION TABLE

Unit Number	Max. Sq. Ft. E.D.R.	Discharge Pressure At Pump	G.P.M. From Radiation	Cap. of Pump	H.P. of Motor	Return Inlet	Pump Discharge	Dia. of Receiver	Height of Unit
TVC 13	500	20 lbs.	.25	1.0 GPM	1/4	2"	1"	21"	21"
TVC 19	750	20 lbs.	.38	1.5 GPM	1/4	2"	1"	21"	21"
TVC 23	1000	20 lbs.	.5	1.5 GPM	1/4	2"	1"	21"	21"
TVC 29	2000	20 lbs.	1.0	3.0 GPM	1/4	2"	1"	21"	21"
TVC 35	4000	20 lbs.	2.0	6.0 GPM	1/4	2"	1"	21"	21"
TVC 41	6000	20 lbs.	3.0	9.0 GPM	1/2	2"	1"	21"	23½"
TVC 47	8000	20 lbs.	4.0	12.0 GPM	1/2	2"	1"	25½"	23½"
TVC 52	10000	20 lbs.	5.0	15.0 GPM	3/4	2"	1"	25½"	27½"

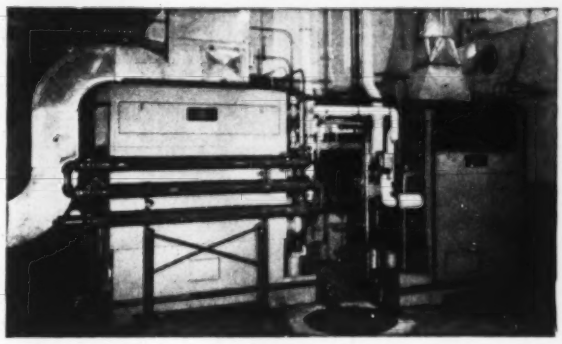
See Bulletin TVC-300-C for Full Specifications

Intermediate Sizes Based Upon Discharge Pressure Required Are Available.

weil PUMP CO. 1514 NORTH FREMONT ST., CHICAGO 22

This NEW METHOD DRIES AIR

PRECISELY AS YOU WANT IT



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

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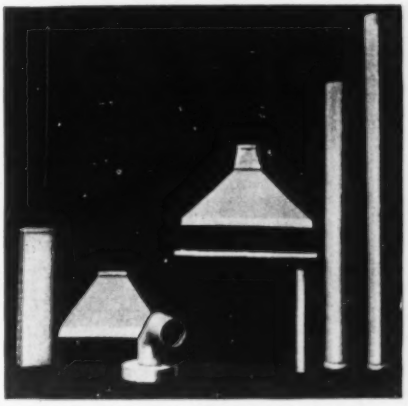
Sales Engineers in Principal Cities of U. S. and Canada

FOR MAXIMUM PROTECTION

From Corrosive Fumes and Liquids



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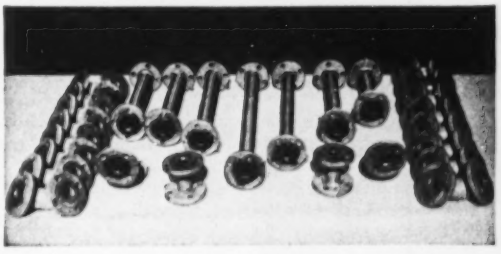
SPECIFY RIGIDON SOLID PLASTIC EXHAUST HOOD AND DUCT SECTIONS FOR ACID FUME SERVICE

Use Rigidon Solid Plastic Hoods & Ducts

- Excellent Chemical Resistance
- Low Initial Cost
- Light Weight and Maximum Strength
- Wide Variety of Standard Designs

For Your Lined Pipe Requirements



Steel Pipe Lined with Neoprene Rubber for Temperature and Corrosion Resistance.

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CORPORATION

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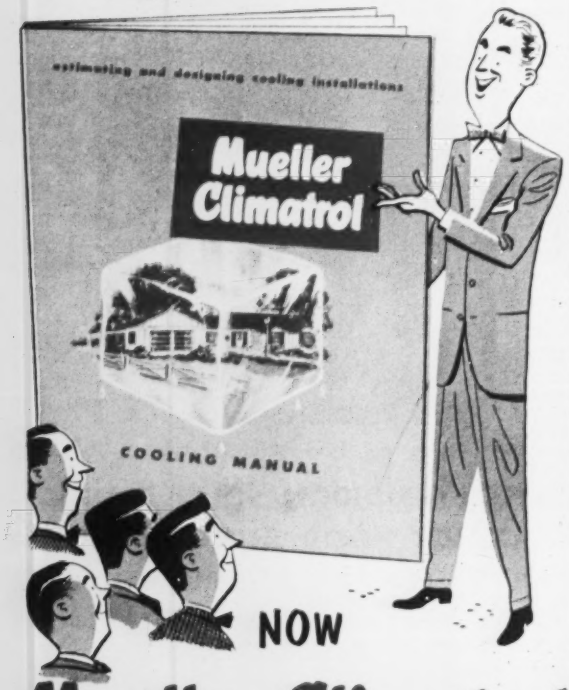
New Cooling Manual Hot off the Press



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Another important service to help your business — from Mueller Climatrol, the Big Name in Heating and Cooling.

Here's complete easy-to-use and down-to-earth advice on how to estimate, how to design cooling installations. It's written by top-notch cooling engineers to help you avoid mistakes — insure that all of your jobs will give complete satisfaction.

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Stainless Steel Electrodes

HPAC 123—Bulletin AR53-16 includes explanation of the two basic types of "Arcaloy" stainless steel electrodes: lime coated for all-position welding with d-c reverse polarity; and a-c and d-c for welding of chrome-nickel steels. Also included are descriptions of the 23 regular analyses and special analyses of "Arcaloy" electrodes, weld metal properties, welding procedures, electrode analysis and color charts, current ranges, and AISI type numbers. [Manufacturer: Alloy Rods Co., York, Pa.]

Stainless Steel Wire

HPAC 124—This new 20-page booklet contains technical data on the application of stainless steel wire. Tables of physical properties, corrosion resistance and analysis are included. A discussion of the principal uses of stainless wire includes welding. [Manufacturer: Allegheny Ludlum Steel Corp., Advertising Dept., 2020 Oliver Bldg., Pittsburgh 22.]

Starter Selection Guide

HPAC 125—Bulletin 1B7733 is a guide to selecting the right starter for squirrel-cage induction motors rated up to 600 hp at 600 volts or less. Included is information on how to select the proper type starter, enclosure and operating arrangement and how to determine whether a full or reduced voltage starter should be used. An explanation of two or three-wire control and hints on the selection of heater elements for overload relays are also given along with a cage motor starter selection chart. [Manufacturer: Allis-Chalmer Mfg. Co., 1171 S. 70th St., Milwaukee.]

Steel Tubing for Radiant Heating

HPAC 126—Supplement No. 1 is a data sheet containing information on the installation of steel tubing for radiant heating. A step by step explanation of the proper procedure includes: preparation of the subgrade; laying the fill; vapor barriers; tubing and reinforcing members; edge insulation; concrete; hydrostatic testing; protective coatings for tubing; neutralizing of fluxes; insulating concretes, and incidental precautions. A cutaway diagram shows the proper position for the various layers. [Manufacturer: Bundy Tubing Co., 8109 E. Jefferson Ave., Detroit 14.]

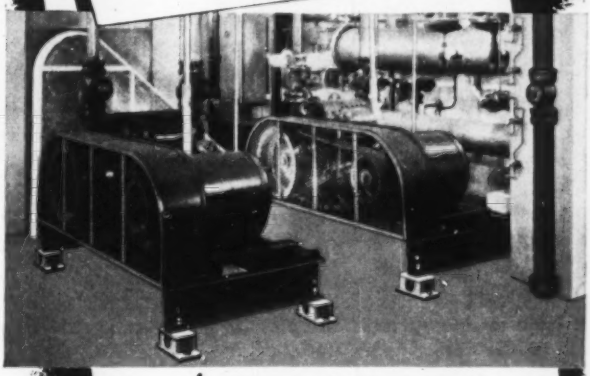
Supplies and Equipment Catalog

HPAC 127—The *Spring & Summer 1953 Estimating Catalog*, is a pricing guide which covers approximately 80 percent of the supplies used in the heating, ventilating, refrigeration and air conditioning fields. Included are specifications for fans, blowers, compressors, accessories, fittings, pumps, coils, condensers, valves, motors, V belt drives, grilles and registers, air conditioners, chillers, etc. [Manufacturer and wholesaler: M. Blazer & Son, 173 Market St., Passaic, N.J.]

Suspended Unit Heaters

HPAC 128—Bulletin 543 illustrates a new line of suspended space heaters for use with any type of gas fuel. The six-page folder gives specification data with dimensions and capacities of both propeller fan and blower type units. Available output capacities of these gas fired suspended heaters range from 70,000 to 178,000 Btu per hr. Full explanations show how they can be used in commercial and industrial applications for heating, ventilating

STOP VIBRATION



with **KORFUND VIBRATION CONTROL**

IN A HOSPITAL, quiet areas must be maintained free from vibration and noise. Korfund Isolators were furnished by The Vilter Manufacturing Company for this installation of two of their Vilter Freon VMC Compressors in the new wing of the Milwaukee Hospital, Milwaukee, Wis. Although these compressors were installed close to quiet areas without special foundations, the Korfund Isolators kept vibration and noise well below the requirements.

In addition to insuring quieter operation, Korfund Vibration Control units can:

- Permit installation *anywhere* in apartment, public and industrial buildings
- Decrease original building and foundation costs
- Permit installation without reinforcing floors
- Lengthen machine life
- Permit higher operating speeds — allowing use of smaller units
- Reduce maintenance costs

We'll gladly send more information on Korfund Vibration Control for compressors, fans, pumps, boilers, air conditioners and other equipment. Write today for your free copy of Bulletin No. 7, or see our catalog in Sweet's Files.

For specific recommendations, contact us or your local Korfund office. A half-century of experience is at your disposal.

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KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK

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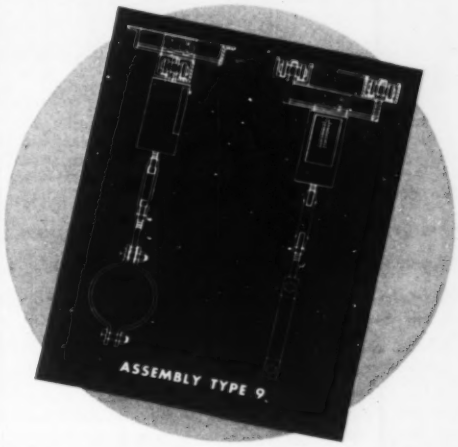
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

HOLD EVERYTHING ...with

BLAW-KNOX OVERHEAD ROLLER ASSEMBLY



Type 9 Functional Assembly (illustrated) provides free rolling action in two directions and freedom of movement in vertical position. Its *internal swivel* action gives full control over all movements, and minimizes absorption of piping thrusts by the connecting flanges . . . a big help in keeping maintenance and replacement costs at rock bottom. Available for all standard size piping. Accommodates operating loads up to 12,000 lbs.

Catalog No. 53 on request.

BLAW-KNOX COMPANY
POWER PIPING AND SPRINKLER DIVISION
PITTSBURGH 33, PA.

BLAW-KNOX

Here's why
specify
CFE CONTROLS

Closed and open view of CFE Damper Control for automatic sequence control of oil, gas and stoker-fired boilers. Designed for use with CFE indicating gages and "Lectricarm" drive unit.

CFE Control Systems cut fuel costs, reduce smoke, soot and fly ash, prolong life of boiler equipment and increase boiler safety. Damper Control illustrated contains, in one compact cabinet, all elements for safe, automatic, electrical remote control, from overfire draft. Standard unit provides:

1. **Purge period before firing**
2. **Open damper until safe flame is established**
3. **Modulated damper holding desired draft during firing period**
4. **Closed damper at end of firing cycle for gas or oil, continued modulation for stokers**
5. **Special "fail-safe" features for complete protection in event of failure of any part of firing or control systems.**

Exclusive optional features of CFE systems

1. ***Integral Minimum Draft Switch*** with time delay to shut down firing when draft is below predetermined rate.
2. ***Adjustable Start Feature*** to provide partial opening of damper for purging boiler without extinguishing pilot. Especially helpful on induced draft installations.
3. ***Purge Period after Firing*** before damper closes. Designed particularly for induced draft systems.

"LECTRICARM"

Sensitive, remotely-controlled, mechanical automatic drive arm for operating dampers. Extra power overcomes binding or warped dampers.

For Assured Results, Specify CFE Instruments and Controls

The CFE line includes damper controls, steam controls, electronic smoke detector-control units, draft, air pressure and flue temperature gages.

Write for 12 page catalog and specification manual.

COMBUSTION INSTRUMENTS & CONTROLS
CLEVELAND FUEL EQUIPMENT CO
FOR EFFICIENCY AND ECONOMY

CLEVELAND FUEL EQUIPMENT COMPANY

7316 Associate Ave. • Cleveland 9, Ohio

and process drying, with or without ductwork. [Manufacturer: Dravo Corp., Heating Dept., Machinery Div., Dravo Bldg., Fifth and Liberty Ave., Pittsburgh 22.]

Temperature Controllers

HPAC 129—Bulletin F 5783 describes the firm's line of "Model 200 Series Capacitrols," direct reading temperature controllers used for on-off and proportioning control for industrial heat control. Also described is the "Capaciline" used for anticipating control action. Operating diagrams and specifications are included. [Manufacturer: Barber-Colman Co., Wheelco Instruments Div., Rockford, Ill.]

Thermometer for Blood Banks

HPAC 130—Bulletin No. T853 describes a recording alarm thermometer for use in blood banks. The bulletin gives information about the use of the thermometer for recording temperatures held in the refrigerator and for giving alarm should the temperature rise above or fall below the safe range. [Manufacturer: The Bristol Co., Waterbury 20, Conn.]

Time and Program Controls

HPAC 131—New applications of electronic time and program controls are described in the folder, *IBM Electronic Utilities Control*. Included are operation of relays, solenoids, and motors to open and close ventilators, turn heating and air conditioning systems on and off, actuate flush valves, switch light circuits on and off, sound signals, and open and close lawn sprinklers and irrigation equipment. [Manufacturer: International Business Machines Corp., Director of Information, 590 Madison Ave., New York 22.]

Turbidity Instruments

HPAC 132—Bulletin 431 describes turbidity instruments, either as indicators or recorders. According to the manufacturer, they are designed particularly for minute concentrations of contaminants in solution but are adaptable for measuring other variations in process stream flows such as dusts, emulsions, color, etc. Specifications and dimensions are given and typical sample installations are shown. [Manufacturer: Ess Instrument Co., 96 S. Washington Ave., Bergenfield, N.J.]

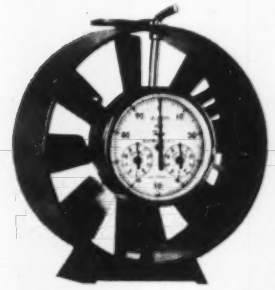
Wall Louvers

HPAC 133—General purpose louvers, fixed and adjustable styles and industrial louvers are detailed and illustrated in this new catalog. Dimensional and construction data, drawings and specifications are given. Information on louver operators and screens also is included. [Manufacturer: The Burt Mfg. Co., Dept. HP, 41 E. South St., Akron 11, Ohio.]

Welding Equipment

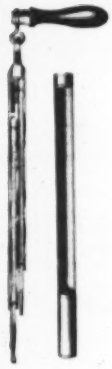
HPAC 134—Three basic a-c welding machines and their accessories are described in Booklet B-5622. Applications are given for a general purpose unit, a 200-ampere welder with a built-in high frequency stabilizer and a general and special purpose 80-volt machine. Each type of welder is described from the standpoints of construction, operation and application. Electrical specifications, physical dimensions and weights of the various models are given. [Manufacturer: Westinghouse Electric Corp., Box 2099, Pittsburgh 30.]

HOW FAST?



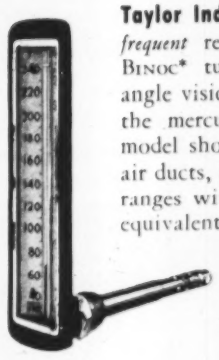
Taylor Biram's Anemometer is designed for use in air ducts, tunnels, furnaces, flues, etc. The three dials register velocity of air currents to 10,000 ft. Each instrument is tested and a chart of corrections furnished for velocities of from 200 to 3,000 ft. per minute. **Catalog #3132. Price $75.00.**

HOW MOIST?



Taylor Sling Psychrometer is considered the basic standard for accurate measurement of relative humidity, since it provides a simple means for creating suitable circulation of air. Length 12". Catalog No. 1321: 30° to 200° in 1° divisions—**$9.00.** Catalog No. 1322: 20° to 120° in ½° divisions—**$9.00.** Catalog No. 1324; 25° to 40° in 1/10° divisions—**$13.00.**

HOW COLD?

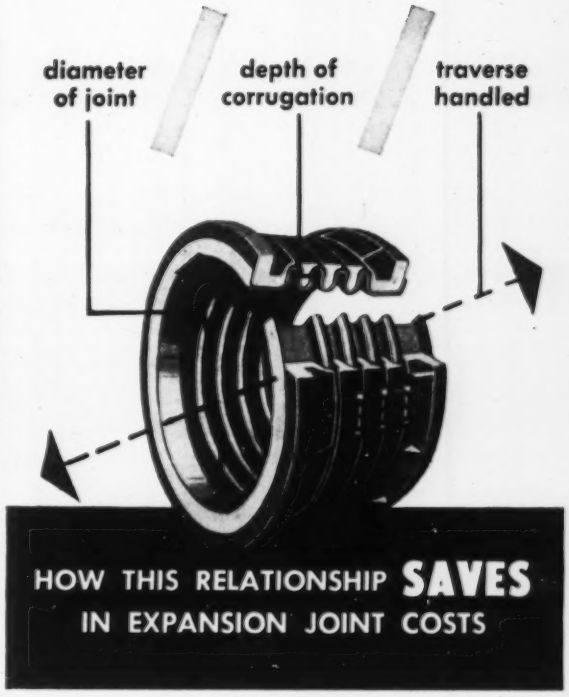


Taylor Industrial Thermometers invite *frequent* reading, thanks to exclusive BINOC* tubing which provides wide angle vision and high magnification of the mercury column. The 90° angle model shown is especially suitable for air ducts, dry kilns etc. Many standard ranges within minus 50 to +400°F or equivalent Centigrade. Your choice of stem angles and connections. Thermometer illustrated (Range 0° to 160°F, 6" stem, 9" scale). **Catalog #12EU349. Price $25.25.** *Reg. U. S. Pat. Off.

There is a Taylor Instrument or control system for every air conditioning need. Ask your Taylor Field Engineer or write Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.*

Taylor Instruments

MEAN ACCURACY FIRST



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For each range of BADGER Expansion Joint Diameters, there is a carefully calculated depth of corrugation and a definite limit of traverse to be absorbed by this corrugation. The traverse is gauged to the depth of corrugation.

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The more you study the Badger Expansion Joint—both the Self-Equalizing Directed Flexing and the Non-Equalizing Types—the more you will see and appreciate the careful engineering that has gone into these joints. And the more you study the work an expansion joint is to do, the more you will appreciate why sound engineering is a 'must' in expansion joints. You get it in Badger Joints.

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

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For spraying, washing, rinsing, cooling and air conditioning, Yarway Spray Nozzles will improve the efficiency of your spray equipment.

There are no internal vanes or other restrictions to clog or hinder the flow.

Yarway Spray Nozzles are available in two types—the Yarway Involute producing fine hollow cone spray with minimum energy loss, and the Yarway Fan-spray for flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Made of metal castings or machined from solid bar stock.

The 20-page Yarway Spray Nozzle Bulletin contains not only complete details on Yarway Spray Nozzles and Fittings, but also much helpful information on the many uses for spray nozzles. Ask for a free copy—Bulletin N-617.

YARNALL-WARING COMPANY

107 Mermaid Ave., Philadelphia 18, Pa.

YARWAY / spray nozzles

WE HEAR THAT

A new research engineering building now under construction by *MODINE MFG. CO.* will more than double the company's laboratory facilities, according to *CLYDE S. SIMPELAAR*, chief research engineer. The building, scheduled for completion this summer, will house four new wind tunnels, a laboratory for the study of bonding materials, new highly specialized research equipment, engineering offices and a technical library.

The *WATERLOO REGISTER CO.*, which for the past several years has been operated as a division of the Associated Manufacturers of Waterloo, Iowa, recently was purchased by *E. T. KELLY* and a group of associates. Mr. Kelly is president and general manager of the firm. Other officers are *WILLIAM B. MOONEY*, secretary and general counsel, and *VERNON H. KYHL*, treasurer. Key plant personnel will be retained by the new organization. Equipment has been moved to a new location at 508 Edwards St. to provide additional space for future expansion.

WILLIAM A. BRECHT recently celebrated his 25th anniversary as president of the *HAJOCA CORP.* In honor of the occasion, Mr. Brecht was recently the subject of a feature article published in the *Philadelphia Inquirer*.

A new mill for the production of copper and brass tubing will soon be opened by the *TRIANGLE CONDUIT & CABLE CO.*, Inc. in New Brunswick, N. J. Completion of the single-story structure is expected in August.

Construction has begun on a new addition to the plant of the *ILG ELECTRIC VENTILATING CO.*, Chicago. The new fireproof, reinforced concrete, two-story building will permit the expansion of the engineering and general offices as well as factory activities. It will occupy an area of approximately 35,000 sq ft. In addition to this building, there will be a one-story crane bay with an area of 7,000 sq ft for the manufacture of large ventilating equipment.

UNITED STATES RADIATOR CORP. has filed a petition before the California Commissioner of Corporations to authorize a proposed exchange of shares of its authorized but unissued common capital stock for shares of *DRAYER-HANSON, INC.* of Los Angeles. The exchange is on the basis of one share of U.S. Radiator stock for six and one-fourth shares of Drayer-Hanson new common stock. Drayer-Hanson's line includes air conditioning equipment, commercial refrigeration units, water chillers, product coolers, finned steel and copper tubing, oil refinery equipment and aircraft components.

In order to demonstrate its product on the spot, *UNISTRUT PRODUCTS CO.* has equipped a 1953 Ford Ranch Wagon as a "rolling exhibit" to bring samples of its bolted framing system and accessories directly to the

SERVING THE HEATING INDUSTRY SINCE 1926

Yula

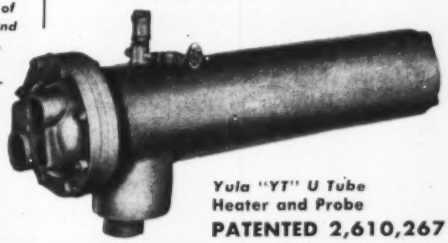
A Complete Line of Dependable Heat Exchangers

Yula-trol Relay box and alarm

Get DOUBLE* PROTECTION for your oil burner installations with . . .

Yula-trol
FUEL OIL DETECTOR
and
Yula "YT" "U" Tube
FUEL OIL HEATER

Approved *by New York City Board of Standards and Appeals. No. 367-50-S.A.*



Yula "YT" U Tube Heater and Probe
PATENTED 2,610,267

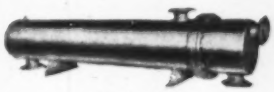
* **Protects system from serious damage, in case of an oil leak in the Pre-heater, by shutting off oil burner, sounding an alarm, flashing on a red light.**
* **Acts as a Low Water Cut-off**

RESULT: Heating System protection at low cost

OTHER *Yula* PRODUCTS

TYPE "M" MIXING VALVE Automatically mixes hot and cold water or other fluids. Delivers it at any predetermined constant temperature.

INSTANTANEOUS HEATERS . . . Ideal for domestic and industrial applications where large volumes of hot water or other solutions are needed for service water supply or process work



CONVERTERS . . . For water in tubes, steam in shell, or water to water applications. "U" tube bundle construction simplifies cleaning.

DRY EXPANSION FREON COOLERS . . . Designed for air conditioning, refrigeration, and industrial and process uses for cooling water or other liquids.

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WEBSTER KINETIC* BURNER

For Low Pressure Gas

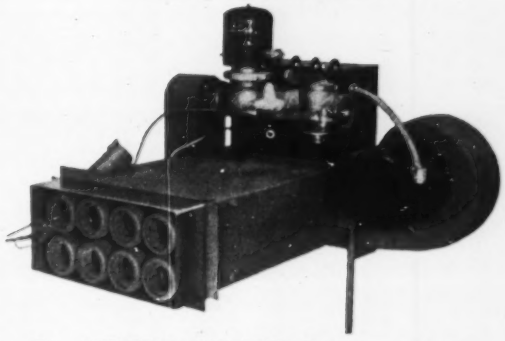
The Webster Kinetic consists of a multiplicity of full venturi mixers with flame retention nozzles. These are assembled in a metal casing complete with pilot and louvre. It may be used with natural, mixed or liquefied petroleum gases. Standby oil burners may be used when desired. As a multiple head assembly it is available in 25 standard sizes of from 4 heads to 48 heads, and can be supplied in any size or shape. Natural gas input ratings from 560,000 Btu/hr to 6,720,000 Btu/hr at 4" wc.

For complete information request Series B8 Bulletins.

WEBSTER DYNETIC*

Forced Draft

GAS BURNER



The WEBSTER DYNETIC Gas Burner consists of multiple venturi tubes with heat resistant alloy, flame retention nozzles assembled in a metal housing and equipped with an electrically driven blower to furnish all of the air for combustion.

All of the valves and controls required for safe, automatic operation, except for thermostat and limit controls, are incorporated in the assembly and wired and tested at the factory. The motor driving the blower is equipped with a centrifugal switch to prevent main gas valve operation unless the blower is functioning.

The burner is available in six sizes for natural gas.

*TRADEMARK

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

buyer. Included in the traveling sample case are all stock channel sizes and fittings, concrete inserts, pipe and cable clamps, tubing clips, pipe roller supports and product literature. If the experiment proves to be a success, the company plans to use a fleet of traveling demonstrators.

The *UNIVERSAL DIFFUSER CORP.*, manufacturer of the "Flexiflo" air diffuser, has moved to larger quarters to provide an additional 10,000 sq ft for manufacturing facilities. New address for the plant and offices is 1360 Carrison Ave., New York 59.

A new series of educational shows sponsored by *PENN CONTROLS, INC.* now is traveling through several mid-western states after a successful tour of the western states. Designed as a service to heating and refrigeration engineers and servicemen, the show includes demonstrations of giant controls which actually operate, colored slides, charts and operating systems demonstrators. Meetings are being arranged and sponsored in each city by local jobbers of the firm.

A new 16 mm sound motion picture, in color, "The Science of Making Brass," has been produced by the *CHASE BRASS & COPPER CO.*, a subsidiary of *KENNECOTT COPPER CORP.* The film, which runs for 29 minutes, depicts the production of brass from its beginning in the casting shop to its final distribution to industry. Products shown in process of manufacture include sheet, rod, wire and tube. Animation is used to explain the details of casting, extrusion, drawing and rolling processes. Inquiries on the film should be addressed to Chase executive offices, Waterbury 20, Conn., or to local Chase warehouses and sales offices.

The *MILLER PRINTING MACHINERY CO.* of Pittsburgh has announced the purchase of the Kerotest Mfg. Co. All Kerotest preferred and common stock has been acquired by the Miller Co. The Kerotest Co. will be operated as a separate company with a few Miller executives acting in an advisory capacity.

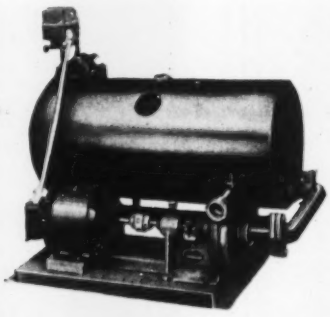
WILLIAM O. WILSON, commercial vice president of *WORTHINGTON CORP.*, announced his retirement last month, after 53 years service with Worthington and its predecessor companies. Since 1944 he has been responsible for general supervision and direction of all the firm's commercial activities in the Chicago, St. Louis, Kansas City and St. Paul district office territories.

At their recent annual meeting, stockholders of Combustion Engineering-Superheater, Inc. voted to shorten the company name to *COMBUSTION ENGINEERING, INC.*

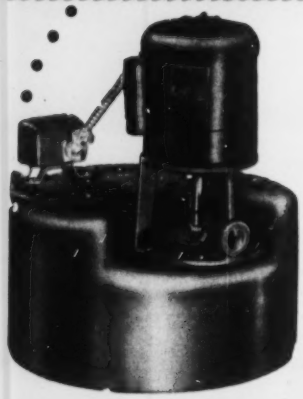
At the same time the board of directors elected the following officers to new posts: *JOSEPH V. SANTRY*, president, was elected chairman of the board and will continue as chief executive officer; *SAMUEL G. ALLEN* retired as chairman of the board but will continue as chairman of the executive committee; *MARTENS H. ISENBERG*, executive vice president, was elected president, succeeding Mr. Santry; *GEORGE D. ELLIS*, vice president

Skidmore Pumps . . .

. . . a long record of dependable performance



TYPE HS PUMP
Capacities range from 1,000 to 65,000 sq. ft. E.D.R.



TYPE CV PUMP
Capacities range from 500 to 10,000 sq. ft E.D.R.

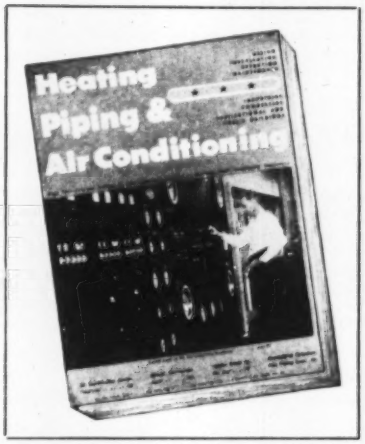
Skidmore has pioneered the manufacturing of quality heating pumps for over a quarter of a century . . . by continual research and development throughout this period, SKIDMORE has set a precedent in the heating pump field for *performance* and *dependability*. There is a SKIDMORE heating pump for each and every heating installation . . . for complete information, see your SKIDMORE representative or write to factory.

SKIDMORE CORPORATION
ST. JOSEPH, MICHIGAN

KEENEY IS HEADQUARTERS

FOR PRACTICAL DATA TO HELP SOLVE YOUR PROBLEMS IN

HEATING, PIPING & AIR CONDITIONING



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You'll get vital data on correct design, installation, operation, and maintenance—as applied to industrial, commercial, institutional and public buildings.

You could make no better start toward solving your own problems in heating, piping and air conditioning than by knowing what successful engineers and contractors have done in working out similar problems. In HP&AC they discuss actual installations, procedures, equipment, objectives, and how specific problems have been met.

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A collection of outstanding papers and data on industrial piping selected from eight years' issues of "Heating, Piping and Air Conditioning." Very comprehensive and practical. Reveals how various difficult piping problems that arose in different industrial plants were successfully worked out by piping experts. Design, installation, operation, and maintenance . . . steam, air, gas, oil, process, water and refrigeration piping . . . piping in food, chemical and textile industries—in refineries, paint, plastic, paper and steel mills—in railroads, utilities, etc.
196 pages, $1.50

• INDUSTRIAL AIR CONDITIONING HANDBOOK

Information on the purpose, cost, design, operation and maintenance of both process and comfort air conditioning systems in manufacturing plants of many kinds. The combined knowledge and experiences of 33 prominent engineers, every one a designer or in direct charge of the largest factory air conditioning systems in operation. This shows other engineers how air conditioning helps speed production, improve products, and increase worker efficiency . . . how to operate systems economically.
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• SNOW MELTING MANUAL

Complete information on correct design, installation and operation of snow melting systems is offered in this reprint of articles originally published in "Heating, Piping and Air Conditioning." Design data based on a study of—and others' actual experience with—over 100 snow melting systems of all kinds. Applications illustrated, for loading platforms and docks; sidewalks; roads; driveways; marquees; parking areas; runways; railway switches, etc., prove that this method costs no more than other methods.
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A practical manual on fume removal, dust collecting, ventilating and exhaust systems for industrial plants. Tells how to design correctly and provide for various ventilation requirements . . . make measurements and analyses of fumes, mists and dusts . . . plan exhaust systems, etc. Twenty eminent authorities contributed also to detailed descriptions of systems in actual operation in many plants, whatever the manufacturing process.
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OK . . . Ship books checked below:

- ☐ Correct Practice in INDUSTRIAL PIPING $1.50
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and controller, was appointed vice president in charge of finance, succeeding *HAROLD H. BERRY*, who has reached the retirement age. Mr. Berry will continue as a director.

VAPOR HEATING CORP. and its manufacturing subsidiary *ROTH MFG. CO.* are building a new $2 million plant at Niles, Ill. Present plans call for occupancy in January 1954. About 300 people will be employed at the new plant and all Chicago manufacturing facilities will be housed there. The company's offices at 30 E. Jackson Blvd., Chicago, will be retained.

Typical electric heating applications are illustrated in a new sound color movie titled, "This Amazing Heat," sponsored by the *EDWIN L. WIEGAND CO.* Designed as an educational aid for management, engineering, production and maintenance men, the film shows resistance-type electric heating units used in a wide range of industrial processes. Case histories show the uses of basic strip, tubular, radiant and cartridge units. Further information and scheduling can be obtained by writing to the firm at 7500 Thomas Blvd., Pittsburgh 8.

A new method of classifying and coding *GENERAL ELECTRIC* welding electrodes, according to the universally accepted nomenclature of the American Welding Society, has been announced by the company's welding department. The new system, according to company engineers, will facilitate the right selection of an electrode for any job, permit proper storage conditions for electrodes to be easily determined, and enable new men to be trained quickly in the selection of correct electrodes.

A completely modern office building for the use of *CARRIER CORP.* will be opened in Atlanta about October 1. The new two-story building will be located at 2005 Peachtree Rd. It will be essentially windowless, completely air conditioned and provided with modern lighting and acoustical treatment.

The general offices of the *PITTSBURGH CORNING CORP.* have been moved to new quarters at One Gateway Center, Pittsburgh 22. The executive, sales and accounting divisions will occupy the 13th floor of the new building.

Ground was broken last month for a major expansion program at the *TIMKEN ROLLER BEARING CO.* plant, Bucyrus, Ohio. Three new single-story buildings will be erected at a cost estimated at $1,250,000. Maintenance, repair, electrical and sheet metal departments will be housed in one building with the office quarters attached. Another structure will include a cafeteria and locker room for 850 employees. The third will house a boiler plant for both process and heating.

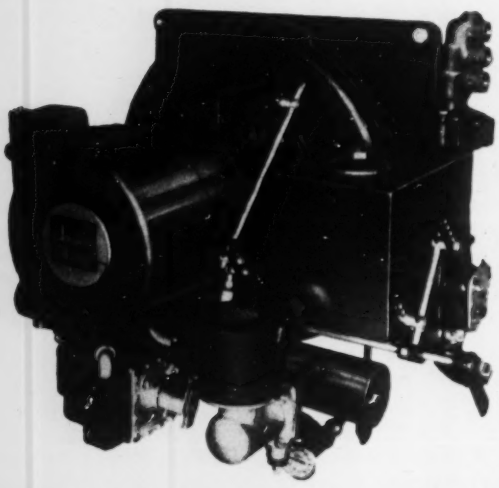
Installation and maintenance methods of room air conditioners are being covered in a series of service clinics for *RCA VICTOR* dealers. The first was held May 4 in Philadelphia. A team of technical experts headed by *H. W. TIMMERMAN* from the RCA Service Co., in

Announcing the **NEW**

JOHNSON *Model 53* Fully-Automatic METERING PUMP BURNER

. . . the burner that has the answer to the problem of

"Cold Starts' and Variable Viscosities!



From the earliest days of the oil-burner industry, engineers have been hunting for an *automatic* method of maintaining a fixed Air-Fuel Ratio regardless of variations in oil temperature and viscosity.

It is very gratifying, in this our 50th Anniversary year, to be able to announce a positive solution to this problem—the Johnson Model 53 Fully-Automatic Metering Pump Burner which out-performs any burner ever built on "cold starts" and automatic operation with heavy oils of varying viscosities.

The key to the phenomenal performance of Model 53 lies in the new positive-displacement metering pump which marks a revolutionary advance in oil-burner engineering combined with time tested pumping principles. When you see the Model 53 you will be impressed by its basic simplicity . . . by its high efficiency . . . and by the easy accessibility of all working parts. Seven sizes are available, from 25 HP to 400 HP. By all means make it a point to investigate this great new burner. It's the biggest oil-burner "news" of the year.

Johnson Oil Burners

Builders of fine Oil Burner Equipment since 1903

S. T. JOHNSON CO.
940 Arlington Ave., Oakland 8, Calif.
Church Road, Bridgeport, Pennsylvania

Speed up Assembly!

Switch to BLACK & DECKER POWER!

BLACK & DECKER HOLGUN* drills holes to ¼" diam. in steel, to ½" diam. in hardwood. Perfectly balanced, light in weight, compact, easy to handle, accurate. Famous "Pistol Grip and Trigger Switch."

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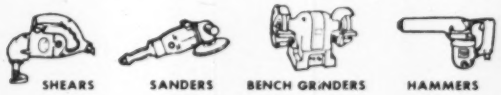
SEE YOUR NEARBY B&D DISTRIBUTOR for demonstrations and full details on this famous team of assembly tools. They'll help your men turn out more work, with less fatigue and less spoilage. And you have nearly 50 other B&D Drill and Screw Driver models to choose from to fit your needs on heavier work! Write for free catalog to: THE BLACK & DECKER MFG. Co., 610 Pennsylvania Ave., Towson 4, Md.

*Trade Mark Reg. U. S. Pat. Off.

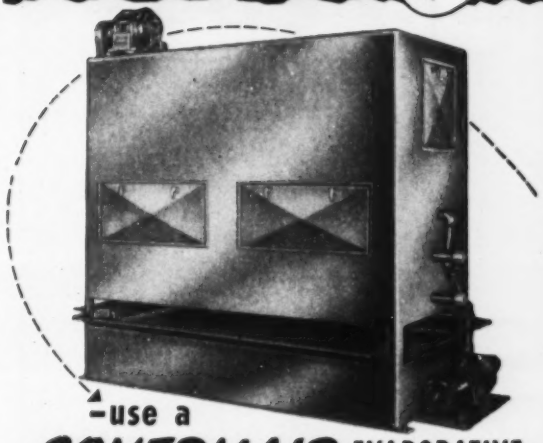


SHEARS SANDERS BENCH GRINDERS HAMMERS

LEADING DISTRIBUTORS EVERYWHERE SELL

B&D Black & Decker PORTABLE ELECTRIC TOOLS

When water is a Headache...



-use a GOVERNAIR EVAPORATIVE CONDENSER

Water supply for air conditioning *can* cause you a lot of trouble. When there's a shortage; when rates are expensive or when sewage and piping are impractical—*water becomes a real headache!*

That's when engineers and contractors alike turn to Governair Evaporative Condensers!

Governair Evaporative Condensers eliminate waste-water disposal problems and pumping costs. And they're engineered to give maximum efficiency and performance at a reasonable cost. Available in sizes from 3 to 100 tons.

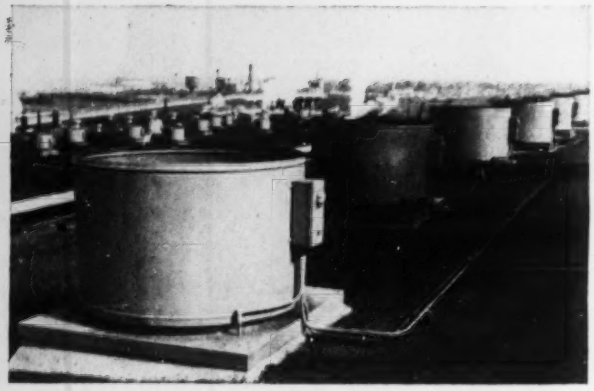
Choose a Governair Evaporative Condenser and there's no need for aspirin! GOVERNAIR CORPORATION, 513 N. BLACKWELDER, OKLAHOMA CITY, OKLA.

GOVERNAIR

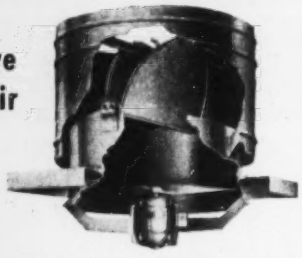
ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS

for a 5,400,000 cfm ventilating job...

FORD CHOOSES SKY-BLAST



100 SKY-BLASTS move massive volume of air at Chicago Aircraft Engine Plant



■ Ford Motor Company, respected for industrial know-how, has installed 100 Propellair SKY-BLASTS to ventilate the forge plant at its huge Aircraft Engine Division in Chicago. Each of these powerful units exhausts 54,000 cubic feet of air per minute, regardless of outside wind conditions. Replacing inefficient ventilators which turned the air down 180°, SKY-BLASTS give vastly increased ventilation and fume-free working conditions.

Built to do a real job

Propellair's SKY-BLAST Ventilator creates a powerful suction, directing the exhaust high into the outside air to be carried away by prevailing winds. Vertical discharge eliminates roof damage from corrosive fumes and heavy dust. Features include famous cast aluminum airfoil propeller, automatic non-leak butterfly dampers, gun-barrel throat, R & M "All-Weather" Motor. Direct-connected for maintenance-free operation. Low silhouette. Easily mounted. Write for the new SKY-BLAST catalog H-680-P

PROPELLAIR®

SKY-BLAST®

POWER ROOF VENTILATOR

PROPELLAIR DIV., ROBBINS & MYERS, INC., SPRINGFIELD, OHIO

cooperation with the company's distributors, is conducting the meetings.

The *INDUSTRIAL AIR CO.* has moved to new and larger quarters at 1116 Great Plain Ave., Needham 92, Mass.

Manufacturers of pressure sensitive adhesive tape products have formed a trade association, known as the *PRESSURE SENSITIVE TAPES MANUFACTURERS ASSOCIATION*. Newly elected secretary of the association is *RICHARD G. BREEDEN, JR.*, Glenview, Ill.

A comprehensive, five-day training program on the *GENERAL ELECTRIC* heat pump has been announced by the company. With a new class beginning every week, the course of study includes principles of the G-E heat pump, application engineering, products service, product features, electric load studies and heat pump sales and promotion. Electric utility personnel interested in attending the Heat Pump Institute may obtain further information from P. F. O'Neill, manager of utility contracts, General Electric Co., 5 Lawrence St., Bloomfield, N. J.

The *NELSON STUD WELDING DIV.* of *GREGORY INDUSTRIES, INC.*, has been appointed national distributor for the stud driver and fastener studs manufactured by Remington Arms Co., Inc.

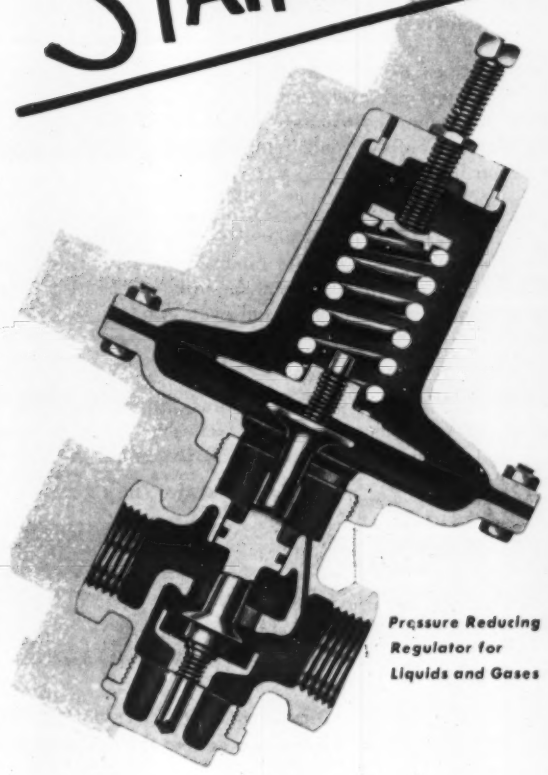
Acquisition of an extra 87,000 sq ft of manufacturing space has been announced by *BUILDERS IRON FOUNDRY*. This is another step in the company's consolidation of manufacturing, office and engineering activities in one area which was begun in 1949.

Salesmen for the *LUNKENHEIMER CO.* have been provided with portable demonstration kits to better explain the features of the firm's "Non-Slip" handwheel. This handwheel is designed so that valves may be closed completely even though hands are wet or greasy. The kit consists of a small hydraulic cylinder and an attached gage which registers in lb per sq in. the amount of thrust applied to the valve stem.

The *BUSH MFG. CO.* of West Hartford, Conn. and the *HEAT-X-CHANGER CO.* of Brewster, N. Y., have announced the opening of a new warehouse and branch office facilities at 1455 W. Congress St., Chicago. In charge of the office force and sales engineers in the field will be *J. K. CAMPBELL*, midwest district manager for both companies.

Formation of the consulting engineering firm of *EICHWALD ASSOCIATES*, with offices at 237 E. 39th St., New York, has been announced by *BERNARD EICHWALD*. The firm will depart slightly from the conventional consulting service in providing an interior design department. Mr. Eichwald, who has been in the construction field for many years, assisted in the design

STAINLESS



Pressure Reducing Regulator for Liquids and Gases

For regulation of fluids where corrosion and contamination are problems, Foster Automatic Valves are now available in all-stainless construction.

All valve parts in contact with fluids may be had in a wide range of corrosion resisting alloys.

The next time you need dependable, trouble-free regulation, it will pay you to tell your Foster Representative your requirements.

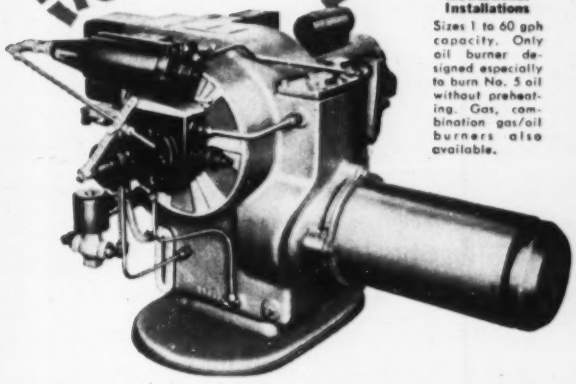
PRESSURE REGULATORS • RELIEF AND BACK PRESSURE VALVES • CUSHION CHECK VALVES • FAN ENGINE REGULATORS • PUMP GOVERNORS • TEMPERATURE REGULATORS • FLOAT AND LEVER BALANCED VALVES • NON-RETURN VALVES • VACUUM REGULATORS OR BREAKERS • STRAINERS • SIRENS • SAFETY VALVES • FLOW TUBES

FOSTER ENGINEERING COMPANY · UNION, N. J.

O.K. to Re-order

For Commercial, Industrial and Institutional Installations

Sizes 1 to 60 gph capacity. Only oil burner designed especially to burn No. 5 oil without preheating. Gas, combination gas/oil burners also available.



Fuel savings up to 30% make HEV-E-OIL Burner *best buy* for you!

No wonder HEV-E-OIL Burner customers are *repeat* buyers! Hundreds of commercial and industrial buyers say HEV-E-OIL Burners helped them save up to 30% on fuel costs by *burning thrifty heavy oils.* Here's what typical owners* say:

"— since installing your HEV-E-OIL burners, we have been using the No. 5 grade oil, this has saved us approximately $900.00."

"— we formerly used 30,000 gallons of light oil per year. Now, with Cleaver-Brooks HEV-E-OIL Burners, we only consume 25,000 gallons of No. 5 oil, which gives us a saving of $700.00 per year."

*Names on request

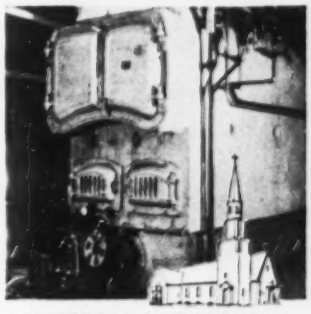
Here's how to get started cutting heating bills 30%

1 Add up your present heating bills — then deduct 30%. This is your approximate saving with HEV-E-OIL Burner.

2 Write for Bulletin AD-102— highly illustrated, with more fact-packed reasons why it will pay you to convert to HEV-E-OIL.

3 Get in touch with your Cleaver-Brooks HEV-E-OIL dealer — he will be glad to make a free survey without obligation.

REMEMBER . . . if you are using 6,000 gals of oil, or more than 45 tons of coal per year — the HEV-E-OIL Burner is the *best buy* for you! Write direct for name of dealer nearest you.



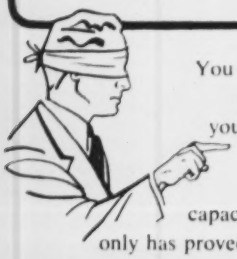
HEV-E-OIL Burner Installed at Bay Shore Lutheran Church, Milwaukee, Wis.

Cleaver-Brooks

BURNER DIVISION · CLEAVER-BROOKS COMPANY

Dept. G, 381 E. Keefe Ave., Milwaukee 12, Wisconsin

DON'T BUY BLIND
when you *buy ventilators*



You select a ventilator on the basis of performance. *But* how can you be sure it will measure up to the claims made for it? The old practice of basing capacities on horizontal wind effect only has proved to be erroneous. THERE IS ONLY *ONE* SURE GUIDE—and that is *certified* ratings based on tests with wind coming from *any* and *all* directions as shown below. That is your best insurance against down-draft and against false ratings.

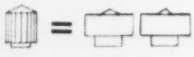
Breidert Air-X-Hausters are *certified* to provide safe, sure ventilation no matter which way the wind blows!

Stationary, no moving parts, nothing to jam or get out of order. It is not necessary to cover Breidert Air-X-Hausters with canvas to prevent drafts during winter or rainy season. The Breidert is the pioneer ventilator to publish certified ratings based on tests* made with wind blowing all directions, as shown at right.

**By Pittsburgh Testing Laboratories*

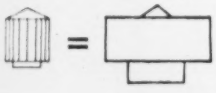
THE BREIDERT AIR-X-HAUSTER DELIVERS BETTER ALL-AROUND RESULTS

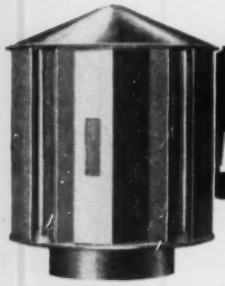
It takes fewer Breiderts to do the job than same size conventional ventilators...



OR

You can use the same number of smaller size Breiderts to do the same job as conventional ventilators.





PAT. NO. 2269428

Breidert Air-X-Hausters

GET ALL THE FACTS! Write today for complete Engineering Data Book, including certified capacity ratings. Address Dept. V.

THE G.C. BREIDERT Co.

3129 SAN FERNANDO ROAD, LOS ANGELES 65, CALIFORNIA

REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES

and installation of electronic equipment for the United Nations in New York. He also handled installation of all electronic equipment in the world's tallest television tower atop the Empire State Building.

DRAVO CORP. has received the National Safety Council's highest award for employee safety. Dravo won the award for its 1952 accident prevention record which was 50 percent better than its previous three-year average and the three-year average for the industry. It was one of the first company-wide awards of honor ever given by the National Safety Council to a firm in the heavy construction industry.

W. M. CHACE CO. has announced the completion of a new wing which will increase bimetal production facilities more than 12 percent. The new facilities will house rolling mills, furnaces for annealing and heating billets and other specialized equipment for producing thermostatic bimetal.

COUPLINGS CO., supplier of brass fittings for copper tubing to wholesalers and manufacturers, has moved to new and larger quarters at 2205 W. Roosevelt Rd., Chicago 8.

Construction has begun on a $2 million addition to the *BLACK & DECKER MFG. CO.'s* branch plant at Hampstead, Md. The 126,800 sq ft addition, which will double the size of the present plant, is scheduled to be completed by November.

J. E. McAULIFFE, president of *TRIANGLE CONDUIT & CABLE CO., INC.*, has announced that the company will sponsor a professional women's golf tournament July 2-5 at the Shackamaxon Country Club, Westfield, N. J. To be known as the Triangle Invitational Round Robin Tournament, it will be an annual affair. Triangle will donate the entire purse and organized charities will participate in the proceeds.

AUTOMATIC SWITCH CO. of Orange, N. J. has established a factory branch at 923 E. Third St., Los Angeles 13. The branch will function as the company's west coast service center.

Advanced training schools for *SERVEL* air conditioning distributor personnel were conducted recently in several cities throughout the country. The schools were conducted by *ROBERT E. DAVIS*, air conditioning service manager; *G. OWEN KUHEN*, assistant air conditioning service manager, and *JOSEPH L. KAPOSTA*, service training representative.

The Sixth Annual Golf Tournament and Dinner of the *REFRIGERATION and AIR CONDITIONING CONTRACTORS ASSOCIATION of CHICAGO* will take place June 11 at the Itasca Country Club, according to Frank L. Haas, chairman of the committee on arrangements. Headquarters are at 228 N. LaSalle St., Chicago 1.

TERMITE DRILLS

Belong in your Tool Kit

BECAUSE... they're ideal for drilling clean, true holes in concrete *in a matter of seconds!*

TERMITE DRILLS save you time and money when anchoring motors, meters, blowers, pumps and other equipment to walls, columns or floors . . . when suspending pipes, ducts, coils or conduits from ceilings, walls, or columns . . . and when running pipe and conduit through floors or walls.

NO DISTURBING NOISE . . . TERMITE'S quiet, pulverizing action quickly penetrates toughest concrete or other masonry to give you accurate holes without fuss or muss. Use with standard electric drills or air motors.

Free Factory Resharpening

Standard diameters from 3/16" to 5". Other diameters up to 8" on special order. Extra lengths available in 12", 18", 24" and 36".

TERMITE DRILLS, INC.
90 N. LOTUS AVE.
PASADENA 8, CALIFORNIA

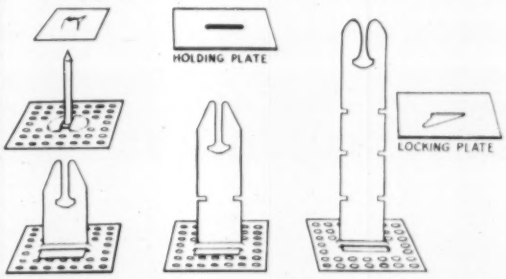
Write for FREE literature and price sheet

LIKE DRILLING THROUGH WOOD

TERMITE
ROTARY MASONRY DRILLS

Use the Stic-Klip Method

for Single Double or Multi Layered



Insulation Installations on All Structural Surfaces.

Stic-Klip Type S Adhesive provides a Bond of Maximum Strength for all Stic-Klips.

Stic-Klip MANUFACTURING CO
50 Regent St. Cambridge 40 Mass.

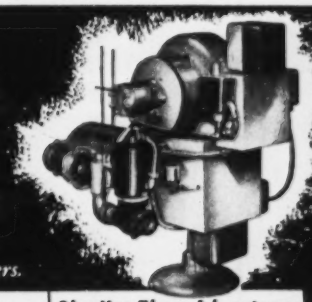
Now! A DUAL FUEL BURNER

Engineered To Insure Peak Efficiency With Both Fuels

GAS and OIL

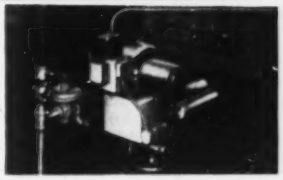
Siemon Power Combi-Matic Burner
employs the forced-draft principle for firing on both gas and oil.

SIEMON
Bonus Built* Burners
offer more to you . . more to your customers.



*Bonus Built Features...	Give You These Advantages
Factory Assembled	Less installation time required.
Factory Tested—for Both Gas and Oil	Insures top "on the job" performance.
Automatic Air Adjustment	Just set it . . . forget it . . .
Motorized Gas Valve	Quiet start-ups; actuates air dampers to correct position.
Automatic Ignition Transformer	Automatic ignition for BOTH fuels.
Uses Standard Controls	Parts always accessible immediately.
Electronic safeguard	Immediate response to flame interruption.
Pressure Safety Control	Prevents opening of either fuel valve unless fan is running and pump pressure proven.
Optional Automatic or Manual Changeover	Will switch automatically from outside temperature or by the flip of a switch.

Model FGO-2200-E
Boiler fired at 2,000,000 B.T.U. input—gas and oil installation in a large Midwestern paper distributing plant



Siemon
Power Combi-Matic
DUAL FUEL BURNERS

Siemon Manufacturing Co.
1819 Holmes, Dept. T Kansas City, Mo.
Please rush literature and "profit plan" details about your Forced Draft Dual Fuel Burner.

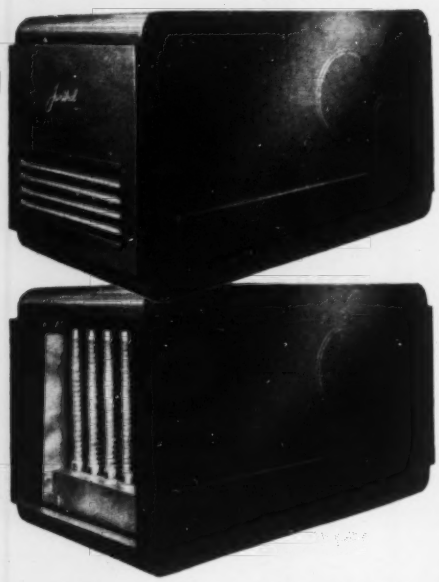
Name_____
Company_____
Address_____
City_____ Zone____ State_____

Most Versatile Warm Air Gas Heating Unit Ever Built!

Model FHS

as a central heating system

as a unit heater



Perfect accessibility and adaptability

A GAS-FIRED UNIT HEATER

Janitrols' inconspicuous good looks and ultra-quiet operation make it an ideal unit heater for installations in schools, churches, offices, stores, sales rooms, restaurants and similar buildings.

Optional use of filters provide a new degree of cleanliness for unit heater operation. Directional louvers give precise air deflection to deliver warm air where most needed.

Four sizes of Janitrol FHS Units range from 65,000 to 150,000 Btu/hr. AGA rated input. Widths range from 17" to 22". Heights range from 23½" to 24⅝". Lengths range from 39½" to 47".

A WINTER AIR CONDITIONER

Here is the most adaptable and different gas heating unit . . . clean, simple, compact design it establishes a new standard in flexibility and economy . . . saves useful floor space, so important in today's trend to compact house designs. This greater freedom in unit placement results in more economical installations whether for perimeter heating, conventional type layouts or Janitrol Save-Way System with Constant Air Circulation and 4" duct.

It is the inherent design combination of the famous Janitrol ribbon burner and multiple heat exchangers that makes this Janitrol so compact and durable*.

*With nearly a million Janitrol steel heat exchangers sold since 1940, replacement of the tubes due to all causes has been less than ¼ of 1%!

Get complete specification data on these new units for better industrial, commercial and residential gas heating. Write for JS-185.

® Janitrol

SURFACE COMBUSTION CORP., TOLEDO, 1, O.

WHO'S WHAT

GEORGE WASSON has been appointed vice president and general manager in charge of production for the *DOMESTIC PUMP & MFG. CO.*

Officers of the *SHEET METAL CONTRACTORS NATIONAL ASSOCIATION* were elected at a recent convention in New Orleans. New officers named are: *A. J. SABATINE*, Altoona, Pa., president; *DEE CRAMER*, Flint, Mich., first vice president; *PAUL STROMBERG*, Washington, D.C., second vice president; *HAROLD HEYSE*, Colorado Springs, Colo., third vice president. Directors to serve for three years are: *JOHN E. CREEGAN*, Hawthorne, N. J.; *W. R. HARTIN*, Columbia, S. C.; *LEO BUDDE*, Dayton, Ohio, and *W. K. BACKMAN*, Des Moines, Iowa.

EDWARD L. RYERSON has retired as chairman of *INLAND STEEL CO.* He will remain as a director of the company. *CLARENCE B. RANDALL* was elected as the new chairman. Mr. Randall was formerly president. *JOSEPH L. BLOCK*, executive vice president, succeeds Mr. Randall as president.

Mr. Ryerson also retired as chairman of *JOSEPH T. RYERSON & SON, INC.*, a subsidiary of Inland Steel.

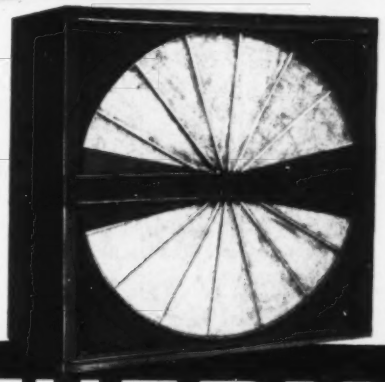
DOLE REFRIGERATING CO. has announced two new appointments: *ANDREW P. BOEHMER* as chief engineer and *WILLIAM C. MUELLER* as advertising manager. Mr. Boehmer was recently director of the Power Laboratory in the College of Engineering of the University of Iowa and formerly was with the Mills Industries as test engineer, applications engineer and assistant sales manager. Mr. Mueller served for ten years with Krafts Foods Co. in Chicago as advertising manager, and was also director of public relations of the Chamber of Commerce at San Diego, Calif.

DAN A. LYNCH has been appointed sales manager of *WINDMASTER CORP.* Mr. Lynch was formerly a manufacturer's representative. He is a well known lecturer on the venting of appliances, and has served as an instructor on central heating for L. P. gas short courses at both Southern Technical Institute and Purdue University.

H. D. S. CHAFEE has been appointed advertising manager of *BUILDERS-PROVIDENCE* and *OMEGA MACHINE CO.* He has been with Builders Iron Foundry since 1946 as manager of several of sales offices.

RICHARD M. GEIS has been appointed advertising and sales promotion manager of the *SCHAIBLE CO.* This is a newly created position. During the past six years Mr. Geis has been an account executive with Ruthruff & Ryan, Inc.

ROBERTS-GORDON APPLIANCE CORP. has announced the appointment of *EUGENE DIRSCHEL* as



HOLD DOWN HEATING OR COOLING COSTS!

THERM·O·WHEEL

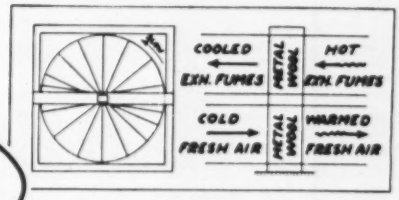
holds heat or cold while exchanging air!

Now, with THERM-O-WHEEL, smaller heating or cooling units can serve a greater area . . . your present systems can be run more economically, with constant ventilation.

HERE'S HOW:

Therm-O-Wheel retains up to 96% of heat or cold by utilizing the "counterflow" principle. The rotating metallic wool in counterflowing air streams permits almost complete transfer of temperatures between exhaust and fresh makeup air. Therm-O-Wheel operates efficiently in any degree of temperature-difference between the two air streams. Ideal for theatres, assembly halls, industrial, chemical and brewing operations, etc.; winter or summer ventilating.

THERM O WHEEL
INCORPORATED



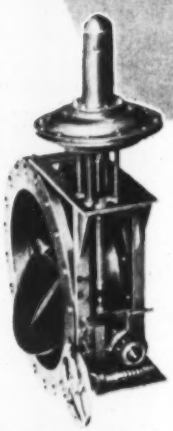
Write for complete details.
Some territories for distributors still open
1042 Twenty-second St., Far Rockaway, N.Y.

for Air Conditioning • Heating • Ventilating • Water Piping

you need

ROCKWELL VALVES

For Air – Gas – Liquids – Solids



W. S. Rockwell standard butterfly valve with air diaphragm operator, declutching mechanism and handwheel.

W. S. Rockwell wafer type butterfly valve with hand lever control.

For uniform, quick control and shut-off, manually or automatically—

For minimum pressure drop when valve is fully open—

You're sure, you're safe with Rockwell butterfly or slide valves—always dependable.

TIGHTNESS—commercial, air- or drip-tight.
CONSTRUCTION—as required.
PRESSURE—to 300 p.s.i.
TEMPERATURE—as high as 2000° F.
CONSTRUCTION—of any metal or rubber-lined.
CONTROL—lever, hand or chain wheel, air diaphragm or cylinder, electric motor, solenoid, etc.
SIZES—from 1" to 120" pipe diameter.

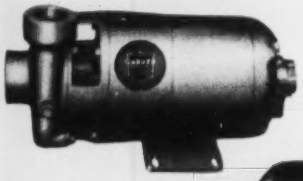
W. S. Rockwell standard slide valve with pull handle; available also with hand lever, handwheel or chain wheel.

Get our Valve Catalog

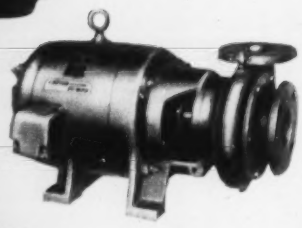
ROCKWELL SINCE 1888 BUILT

W. S. ROCKWELL COMPANY
2543 ELIOT STREET • FAIRFIELD, CONN.

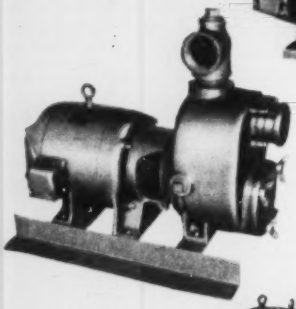
Got a Pumping problem? Let CARVER Help You Get Top Performance!



MODEL B ELECTROPUMP
5 to 70 G.P.M.



TYPE L ELECTROPUMP
30 to 900 G.P.M.



MODEL "K" PUMPS
Self-Priming
20 to 4000 G.P.M.

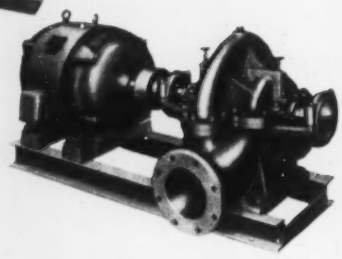


Fig. "400"
SPLIT-CASE PUMPS
200 to 2000 G.P.M.

Whatever your requirements there is a pumping unit in CARVER'S Complete Line that will fit your needs to a "T". On the easy jobs or the tough ones, the outstanding performance, inherent high efficiency and improved hydraulic design of CARVER PUMPS give you thoroughly dependable operation with full pumping economy . . . your best buy for better pumping. A few of them are illustrated.

Ask CARVER for the answer to your pumping problems . . . today. Give us the conditions, we'll give you the answer.

CARVER PUMPS are available with motor, gasoline engine, diesel or belt drive.

CARVER PUMP COMPANY
1460 Hershey Ave., Muscatine, Iowa

CARVER
the quality name in pumps

works manager and *JOHN CRIM* as his assistant. Mr. Dirschel has been with the company since 1942 and was formerly assistant plants manager. Mr. Crim was previously with Westinghouse.

R. A. SHERER has been appointed sales manager of *WHITE-RODGERS ELECTRIC CO.*, St. Louis. Mr. Sherer has been with the company since 1913 and most recently was Chicago regional manager.

Several changes have been announced by the *BABCOCK & WILCOX CO.: J. E. BRINCKERHOFF*, formerly sales manager of the Refractories Div., has been named general manager of the division; *C. L. NORTON, JR.*, formerly technical director, will become executive assistant in charge of all development and engineering activities; *CARL CLAUS*, formerly superintendent of the Augusta works, will become executive assistant in charge of all sales and manufacturing operations; *MARK J. TERMAN*, formerly district manager of the Pittsburgh office, will become sales manager; *BRADFORD HOOPER*, who had been assistant to Mr. Norton, will become technical director; *ROYCE K. MACK*, formerly assistant to Mr. Claus, will become superintendent of the Augusta works; *W. H. ROWAND*, chief engineer of the boiler division, has been elected a vice president of the company; *M. NIELSEN*, a vice president of the company, has been placed in full charge of the manufacturing department of the company's boiler division.

Three newly elected directors of the company are *EDWARD L. COCHRANE, J. H. KING* and *LUKE E. SAWYER*.

The company also announces the establishment of an Atomic Power Div. Heading the new division is *C. H. GAY*.

CHARLES W. YARRINGTON has been appointed general superintendent of the Cleveland mills of *CHASE BRASS & COPPER CO.* He has been associated with the company as staff engineer since September 1952 and was previously with the Reynolds Metals Co. Mr. Yarrington replaces *ALBERT T. BOTH*, who has been appointed works manager of the Cleveland branch. Mr. Both has been connected with the corporation since 1925.

MID-STATES WELDER MFG. CO. has announced that a father and son team will head the sales and management of the company. *WILLIAM W. JETTER*, the son, is president of the company, and *J. WILLIAM JETTER*, the father, is vice president and general sales manager.

RALPH C. KNIGHT has been appointed to the newly created position of director of sales of the New York offices of *NIAGARA BLOWER CO.* Mr. Knight has been with the company since 1942 in charge of New England sales and application engineering.

The *NATIONAL ASSOCIATION OF CORROSION ENGINEERS* has announced several technical committee

AIR YOUR VENTILATION PROBLEMS WITH PENN DYNAFANS

No doubt about it—Penn Dynafans increase employee efficiency in your customer's plants by exhausting the "hot spots." This rugged unit can be depended upon to handle the toughest ventilation problems . . .

- Motors out of the air stream, safely remove dust, heat, fumes, vapors, etc.
- Economical to install and operate.
- Sizes range from 250 c.f.m. to 30,000 c.f.m.
- Pulling power is positive and units will not overload regardless of resistance.
- Units are quiet running and have a low clean silhouette.

Write for complete literature today.
Representatives and Distributors in Principal Cities.

PENN VENTILATOR CO.
PHILADELPHIA 40, PENNSYLVANIA

FOR MORE THAN 25 YEARS THE BUILDERS' ROOF TOP LINE!

Manufacturers' Agents

Are you interested in securing additional lines?

We are occasionally asked by our manufacturer advertisers to suggest the names of manufacturers' agents in various sections of the country whom they can contact in regard to representation of their heating, piping and air conditioning.

If you would like your name listed on our records for inquiries we may receive on your territory, we invite you to write us. There is no charge in connection with this service.

Heating Piping & Air Conditioning

6 N. Michigan Ave. Chicago 2, Ill.

changes: *H. W. SCHMIDT* of The Dow Chemical Co., is chairman of the overall Technical Practices Committee; *R. C. BUCHAN*, Humble Oil and Refining Co., is chairman and *E. C. GRECO*, United Gas Corp., is vice-chairman of TP-1 on Corrosion of Oil and Gas Well Equipment; *L. P. SUDRABIN* of Electro Rust-Proofing Corp., has been named chairman of TP-4 on Minimum Currents Requirements for Cathodic Protection; *A. J. LIEBMAN* of Dravo Corp., is now vice-chairman of TP-6 on Protective Coatings; *PAUL J. GEGNER* of Columbia-Southern Chemical Co. is the chairman of TP-5 on Corrosion Problems Involved in Processing and Handling Chemicals; *H. O. TEEPLE*, of the International Nickel Co., Inc. is chairman of a newly organized sub-committee TP-5 D on Corrosion by Organic Acids and Bases.

WESTINGHOUSE ELECTRIC CORP. has appointed *W. ALLEN BRECHT* as consulting engineer for the company's Atomic Power Div. Mr. Brecht was formerly consulting engineer to the vice president in charge of the company's East Pittsburgh plant. He has been with the company since 1922.

THOMAS D. CARTLEDGE has been elected as vice president of *UNION CARBIDE AND CARBON CORP.* Mr. Cartledge was formerly president of Linde Air Products Co., a division of the company.

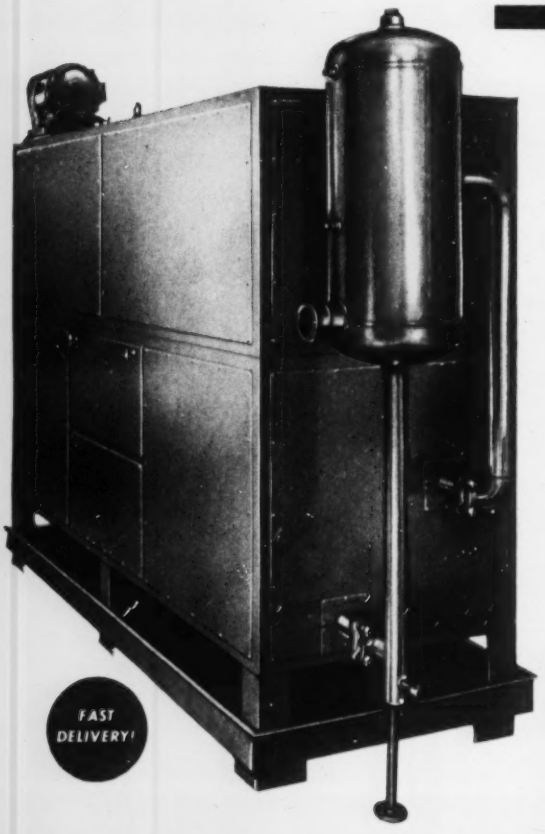
BONNEY FORGE & TOOL WORKS has announced the appointment of *ROGER O. BAY* as sales manager of the tool division of the company. Mr. Bay, previously sales manager of the automotive division of Cleveland Pneumatic Tool Co., will direct sales of the firm's mechanics' hand tools in the automotive, refrigeration, industrial, hardware, farm implement and marine markets.

Several new appointments have been announced by The *YOUNGSTOWN SHEET AND TUBE CO.* The following are in the sales and order departments of the company: *RALPH W. MOWRY*, formerly manager of the order department is now assistant manager of flat rolled sales; *DAVE LEWIS*, previously assistant manager of the order department, is now manager, and *GEORGE L. WILLIAMS*, assistant manager of the order department in the company's Chicago offices, has been promoted to manager.

Four advancements have been announced in the administrative departments of the firm. They are as follows: *WALTER E. WATSON*, formerly first vice president and a director, is now on the executive committee; *ALFRED S. GLOSSBRENNER*, previously vice president in charge of operations, was elected to the board of directors; *LEW E. WALLACE*, formerly general manager of sales, is now assistant vice president; *MYRON H. WATKINS* replaces Mr. Wallace as general manager of sales.

Personnel changes at the Indiana Harbor plant are *ELMER J. KELLER*, formerly assistant chief inspector, who has been appointed superintendent of Youngstown's harbor pipe mills, and *EMMETT E. HOLMGREN*, who succeeds Mr. Keller.

The company also announces that five students have completed their sales training and have been assigned to



AVAILABLE **RIGIDBILT** PRODUCTS

CEILING TYPE AIR CONDITIONING UNITS	STANDARD STEAM HEATING COILS
FLOOR TYPE AIR CONDITIONING UNITS	STEAM DISTRIBUTING TUBE HEATING COILS
VENTILATING UNITS	HOT WATER HEATING COILS
DIRECT EXPANSION COOLING COILS	SUSPENDED TYPE UNIT COOLERS FOR ALL REFRIGERANTS
WATER COOLING COILS	FLOOR TYPE PRODUCT COOLERS

SPECIAL COILS FOR ALL REFRIGERANTS
DESIGNED TO MEET THE MOST EXACTING REQUIREMENTS

RIGIDBILT IS BETTER BUILT—Write for Catalog.

RIGIDBILT INC.

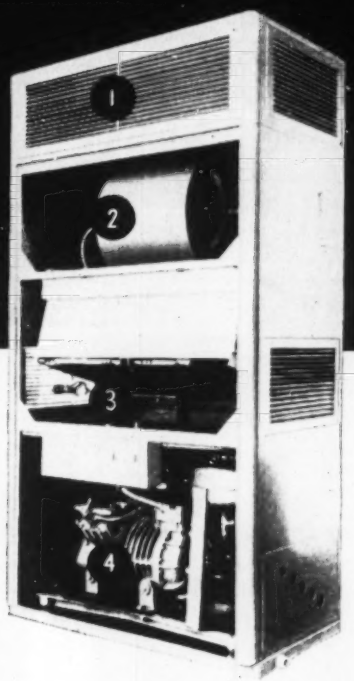
2852 W. FULTON ST. CHICAGO 12, ILLINOIS

Floor Type Product Cooler
FOR FULL-FLOODED AMMONIA.
Units of this type for *all* refrigerants and applications.

AIR CONDITIONING UNITS HAVE TO BE RELIABLE . . .

Every time you recommend an air conditioning unit, you lay your reputation on the line. The unit has to meet the requirements of the job in each and every case.

With BAKERAIRE, constant, accurate output is assured by balanced functioning of all parts.



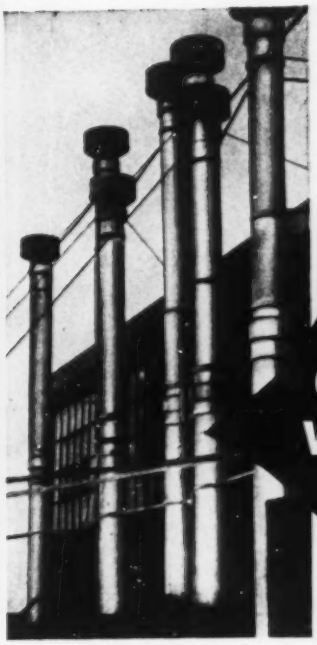
1. Plenum diffuses air in any direction by simple adjustment of louvres.
2. Slow speed, full air capacity of the Fan Section balances with
3. The Coil Section, in which a 5 row coil has ample surface to remove moisture and heat, balanced with
4. The quiet efficient Compressor Section where the controls are integrated for automatic operation and complete safety protection. For final protection the interlock relay prevents short cycling of the compressor unit.

These features cut installation and maintenance time costs:

- All water connections are run to an external utility panel, eliminating inconvenient internal connections
- All electrical connections are integrated in one panel in front of the unit
- All functional parts are easily accessible through the removable panels

For further information, just write to:

BAKERAIRE CORPORATION
South Windham, Maine
Offices in Principal Cities



18 YEARS OF TOUGH VENTING HAS PROVED . . .

. . . TRANSITE* INDUSTRIAL VENT PIPE *lasts longer*

Transite Industrial Vent Pipe is known to many users for its exceptionally long service life. In lines where aggressive gases, fumes and vapors are present, it has proved itself time and time again. Maximum corrosion resistance is imparted to asbestos, cement and silica during manufacture which includes a special Johns-Manville steam curing process. Transite has paid for itself, sometimes over and over again, on many installations.

In addition, Transite Industrial Vent Pipe cannot rust. It needs no painting or other protective treatment. It has been used as ducts, vents or stacks for 15 to 20 years and longer . . . remaining in excellent condition . . . outlasting other material by a wide margin. (Transite has served the factory shown above for 18 years.)

Transite is light in weight and easy to handle. It can be cut and drilled with ordinary tools. It comes in a complete range of sizes up to 36" in diameter. A full line of corrosion-resistant Transite fittings makes it adaptable to practically any job requirement.

For further details on Transite Pipe for your venting problems, simply fill out and mail the coupon to Johns-Manville, Box 60, New York 16, N. Y. In Canada: 199 Bay Street, Toronto 1, Ontario.

*Transite is a registered Johns-Manville trade mark

Johns-Manville
TRANSITE
Industrial Vent
PIPE

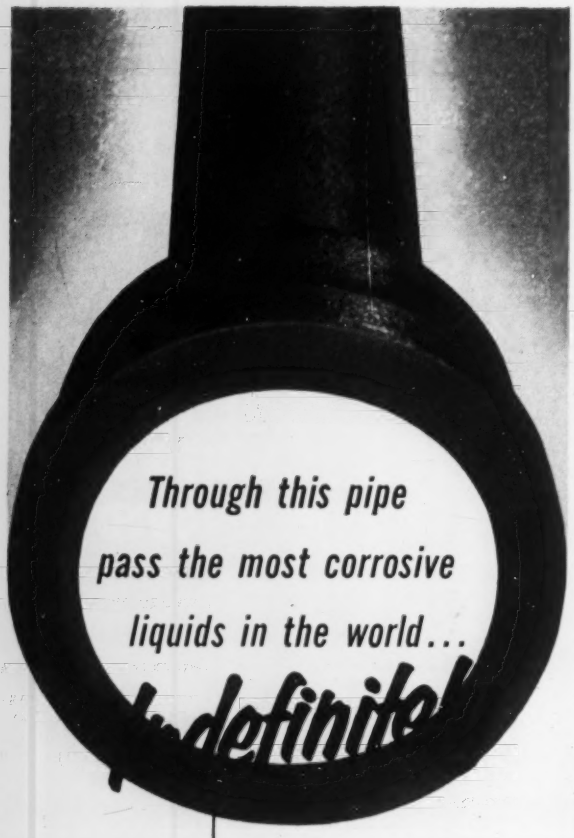
Johns-Manville
Box 60, New York 16, N. Y.

Gentlemen: For facts about longer-lasting vent pipe, please send me Data Sheet Series DS-336.

Name _____

Address _____

City _____ State _____



Install DURIRON acidproof drain pipe

Duriron is a high silicon iron alloy with very high resistance to most commercial acids at practically all concentrations and temperatures. Resistance is as thick as the pipe wall itself.

Duriron is installed by the same plumbing methods as ordinary cast iron soil pipe. BUT . . . in most cases this is the *last cost*, since Duriron will generally outlast the building.

Available in standard fittings, Duriron is widely used in schools, hospitals, industrial plants, battery stations, emergency lighting plants, kitchens—wherever corrosive waste disposal is a problem. Write for Catalog PF/1.

DURIRON
LOOK FOR THE NAME ON EVERY PIECE

THE DURIRON COMPANY, Inc.
404 North Findlay Street
DAYTON, OHIO

the following offices: *PHILLIP CLARKE* to St. Louis; *JOHN DALE* to Cincinnati; *JAMES HALE* to Columbus; *WILLIAM STEWART* to Washington, D. C., and *KENNETH WEST* to Grand Rapids, Mich.

NATIONAL RADIATOR CO. announces several new appointments: *RAYMOND S. DOHERTY* is now manager of National Packet sales in the heating division of the firm; *SIGMOND MOROH* is manager of accessories sales in the heating division, and *WILLIAM C. CALLIHAN* now is assistant manager of accessories sales.

A. B. CLYMER, an administrative engineer, has been appointed by *BITUMINOUS COAL RESEARCH, INC.* to the Columbus staff. Mr. Clymer's responsibilities will include the initiation of new research projects and the design and installation of administrative systems.

TINNERMAN PRODUCTS, INC. has announced the election of two executives to new positions. *ROBERT C. OVERSTREET*, vice president and secretary of the company, was elected executive vice president and re-elected secretary. *JOHN E. POTTER*, controller, was elected treasurer.

SHERMAN J. LARSEN has been appointed sales manager for the Architectural Products Div., *BURGESS-MANNING CO.* Mr. Larsen was formerly manager of the Pliojet Department of Plibrico Co.

CALUMET & HECLA, INC. has announced appointment of *HORACE Y. BASSETT* as vice president of operations at the firm's offices in Chicago. He was formerly vice president and general manager of the company's Wolverine Tube Div.

SAMUEL P. FELIX has been appointed general manager of the *DE LAVAL TURBINE PACIFIC CO.* Mr. Felix has been with the company since 1939 and most recently held the position of superintendent of the company's North plant.

A. M. BYERS CO. has announced the appointment of *BUCKLEY M. BYERS*, grandson of the firm's founder, as general manager of wrought iron sales. Mr. Byers has been associated with the company since 1940 and was recently assistant manager of steel sales.

DAVID E. FEINBERG, a vice president of *UNITED STATES AIR CONDITIONING CORP.*, has been elected a director. *R. D. McLAIN* has been named manager of sales of the refrigeration division and *C. F. HAWKINSON* has been appointed manager of sales of the general equipment division.

WILLIAM H. CHASE has been appointed advertising and sales promotion manager of *FEDDERS-QUIGAN CORP.*, succeeding *ROBERT A. CASSATT*, recently pro-

Residential AIR CONDITIONING *Without Water!*

UNICON

by KRAMER

A Remote Type Air-Cooled Condenser that completely eliminates water, sewerage and plumbing problems.

SPECIFICALLY DESIGNED FOR RESIDENTIAL APPLICATION

Unusually Quiet!

WRITE FOR BULLETIN No. U 250

KRAMER TRENTON CO.
Trenton 5, N.J.

SCHMIDT 42

3 WINNING NUMBERS in Hot Water Heating Vents

MAID-O'-MIST AUTO-VENTS

NUMBER 7

For pressures up to 75 lbs. This self-closing, float-operated valve gives positive action for such large capacity, continuous venting jobs as

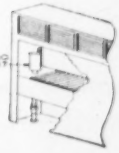
- Venting trapped mains and circulating lines
- Venting hot water convector radiators
- Venting high points on mains

No air chamber required. Size 4⅜ x 2¼". Send for Catalog Sheet No. 7.

NUMBER 67

For pressures up to 30 lbs. Designed for limited space, this self-closing, float-operated valve provides positive action for such continuous venting jobs as:

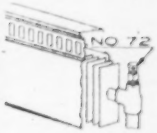
- Venting convector radiators
- Venting baseboard radiators



No air chamber required. Size 3-3/16 x 1½". Send for Catalog Sheet No. 67.

NUMBER 72

A fast venting valve of the expansion type. Its small size and responsive action make it ideally suited to such venting jobs as



- Venting convector radiators
- Venting free standing radiators
- Venting baseboard radiators

No air chamber required. Size 1¼ x ½". Send for Catalog Sheet No. 72.

MAID-O'-MIST INC.

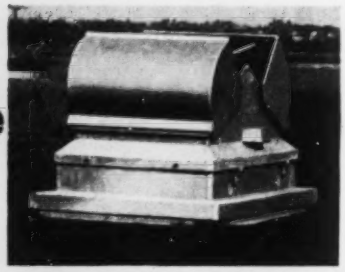
3215 N. Pulaski Rd.
Chicago 41, Illinois

AUTOMATIC HUMIDIFIERS FOR ALL TYPES OF HEATING SYSTEMS

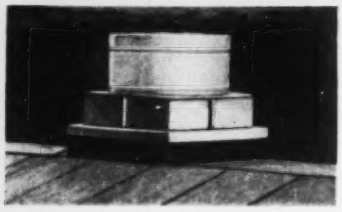
Swartwout

"Straight Through" Ventilators provide efficient economical spot ventilation

Ject-O-Valve



Whirlout



FOR many situations where fast powerful exhaust is desired above furnaces, ovens, pickling vats, or any operation or condition that causes heat, smoke or fumes, the straight-through type roof ventilator throws out unwanted elements in a hurry. Outgoing flow is as direct as possible, encountering practically no friction or obstructions. The air stream from a motor-driven fan automatically opens the ventilator and keeps it open while operating. Rain and snow are swept aside while unwanted air is being expelled. Swartwout has engineered these ventilators carefully for long life and completely satisfactory performance. They mount on any type of roof.

Ject-O-Valve is completely enclosed when not in operation, and a solenoid-actuated lock holds top sections secure when closed. Made in 5 sizes, 28 capacities. Write for Bulletin J-F.

Whirlout provides economical, effective ventilation with simple, sturdy construction. Half-disc dampers are pivoted at the center of its circular opening. 10 sizes, wide capacity selection. Write for Bulletin **WH-H.**

See our catalog in Sweet's Engineering or Architectural Files

18511 Euclid Avenue, Cleveland 12, Ohio

The Swartwout Co.

Roof Ventilators and Ventilating Louvers

POWER PLANT EQUIPMENT • PROCESS INDUSTRY CONTROLS

moted to sales manager of the Refrigeration Appliances Div.

STERLING ALEXANDER has been appointed assistant sales manager of the *HENRY VALVE CO.*; he will act in a supervisory capacity in connection with all sales personnel and in charge of export sales.

JUDSON C. TRAVIS was elected president of *HANDY & HARMAN* after having served the company for 35 years. He succeeds *G. H. NIEMEYER*, who will continue as a member of the board of directors, chairman of the executive committee, and president of *HANDY & HARMAN OF CANADA, LTD.* Other officers re-elected were: *C. W. HANDY*, chairman of the board, *H. W. BOYNTON*, vice president and treasurer; *J. W. COLGAN*, vice president in charge of sales, *F. C. JONES*, vice-president in charge of production and research.

Two newly elected vice presidents of *DRAVO CORP.* are *JOHN K. BEIDLER*, general manager of the Machinery Div., and *LOUIS P. STRUBLE, JR.*, general manager of the Keystone Div. *CLIFFORD A. HILL* was elected treasurer and *EDWARD T. FITCH*, controller.

PHILIP J. BERG now will supervise the sales of heaters, crane cab coolers, fabricated piping and construction projects in the Detroit office of the corporation.

The *SWARTWOUT CO.* has announced the following appointments: *ERNEST H. BELLARD*, general sales manager; *M. M. WARD*, sales manager, Power Plant Div.; *ROBERT J. JONES*, sales manager, Process Div.; *JAY P. JOHNSON*, sales manager, Ventilation Div., *ROBERT K. DICK*, advertising manager, in charge of promotion activities of all three divisions. *KENYON SWARTWOUT* has been named executive vice president.

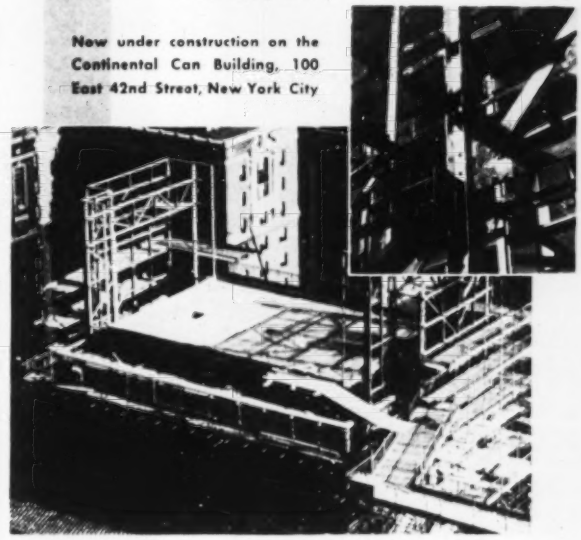
C. S. DAVIS, JR., president and general manager of the *NORGE HEAT DIV.* of *BORG-WARNER CORP.* was elected a member of the board of directors.

F. S. CORNELL has been named executive assistant to the president, L. B. Smith, of the *A. O. SMITH CORP.* Mr. Cornell will continue as manager of the Permaglas-Heating Div. at Kankakee, Ill. A four-man committee, who will administer the division's operations under Mr. Cornell, are: *R. S. FRIEND*, works manager; *W. W. HIGGINS*, chief engineer; *S. E. WOLKENHEIM*, general sales manager, and *D. J. O'CONNEL*, business administration.

HARRY A. WINNE, former vice president of engineering of the *GENERAL ELECTRIC CO.*, has been named to a new post performing special assignments for the company. Succeeding him is *CLARENCE H. LINDER*, former vice president and general manager of the major appliance division. Succeeding him is *CHARLES K. RIEGER*, former vice president and general manager of the small appliance division. *WILLARD H. SAHLOFF*, former general manager of the electronics division radio

New York's largest all aluminum water cooling tower

New under construction on the Continental Can Building, 100 East 42nd Street, New York City



When Zimmermann & Luks, 500 Fifth Avenue, New York City, were employed as consulting engineers to air condition the offices of the Continental Can Company, they found the design of the building was such that the weight of a steel cooling tower of sufficient capacity, would be too great a load for the structural members of the building.

It was decided that an all aluminum construction was necessary and Zimmermann & Luks chose the Water Cooling Equipment Company to design, fabricate and erect an aluminum tower. All angles, channels, gusset plates, bolts and nuts, and the basin are constructed of aluminum. The only major parts of the tower not made of aluminum are the redwood fill, the redwood drift eliminators, the fans, motors, and gears.

In this manner a difficult engineering problem was solved. When you have unusual water cooling tower problems, choose Water Cooling Equipment Company for design, fabrication and erection.

Manufacturers of various types and sizes of mechanical draft and atmospheric cooling towers.

Architectural
Industrial construction
Plant engineering

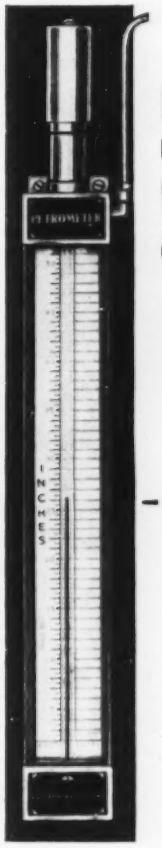
Water Cooling EQUIPMENT COMPANY

WCEC

MAIN OFFICE • 8601 New Hampshire Ave. • St. Louis 23, Mo.

Fabricating Plants: St. Louis, Mo. • Arcata, Calif. • Houston, Texas

REPRESENTATIVES IN THIRTY-SEVEN PRINCIPAL CITIES



PETROMETER
REMOTE READING LIQUID DEPTH GAUGES

"Bring Your Liquid Level to Eye Level"

THE BEST GAUGE FOR:

Commercial and Industrial Fuel Oil Storage Tanks

Domestic Installations with Buried Tanks

Storage Tanks for other Industrial Liquids—gasoline, solvents, acids, etc.

HERE'S WHY:

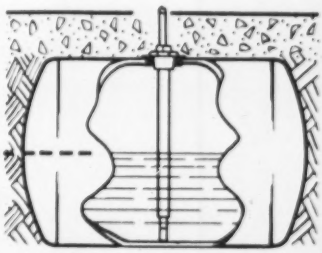
Can be installed on tanks above or below the ground and up to ¼ of a mile away.

No troublesome moving parts—operates on the principle of the U-tube. Simple, dependable and accurate.

Large, easy-to-read vertical scale gives tank contents at a glance. Scales are easily changed for different liquids.

Easy to install—the tank assembly for the gauge can be installed when the tank is empty or when containing liquid. It can also be installed separately to complete the tank work. The gauge can be connected any time later. Only one simple connection to tighten.

WRITE FOR BULLETIN PH TODAY.



FOR TANKS 20 INCHES TO 50 FEET DEEP.

LIQUIDEPTH INDICATORS, INC.

43-22 TENTH STREET

LONG ISLAND CITY 1, N. Y.

Sarcotherm
Modulating Heat Control

Residence of William Nicholson 3rd at Smoke Rise, Carl Kemm Loven, A.I.A., Architect . . . Sarcotherm equipped.

Selected for
SMOKE RISE
Luxury Homes

Ninety-one distinctive, custom built homes have been completed in this exclusive club development comprising 5000 acres of unspoiled country near Butler, New Jersey, 30 miles northwest of New York.

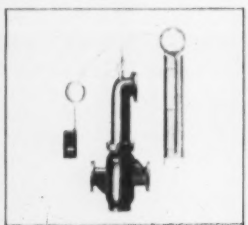
Prominent among outstanding modern improvements built in by the architect, Carl Kemm Loven, A.I.A., of Glen Rock, N. J., is the extensive use of

RADIANT HEATING

with Sarcotherm Control, thus assuring complete comfort for the occupants under all weather conditions.

For full information ask a Sarcotherm engineer to see you—there is one near you—or write for complete catalog.

The heart of the Sarcotherm control system for radiant or forced hot water heating is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they anticipate changes in heat loss ratio, thus maintaining comfort temperatures under all conditions.



The Sarcotherm Comfort Control "Thermoray" is an extremely sensitive thermostat affected by both radiation and convection.

Sarcotherm 21A

SARCOTHERM CONTROLS, INC. • Empire State Bldg. • NEW YORK 1, N. Y.

A SARCO PRODUCT

and television department, becomes general manager of the small appliance division.

Election of *J. T. RYAN, JR.* as president of *MINE SAFETY APPLIANCES CO.* has been announced. He succeeds *GEORGE H. DEIKE, SR.*, now chairman of the board.

IN THE TERRITORIES . . .

For *EUTECTIC WELDING ALLOYS CORP.*—The establishment of an eastern divisional office at the Industrial Bldg., 1060 Broad St., Newark, N. J. *HERMAN J. GREIF* is sales manager.

For *FLEXIBLE TUBING CORP.*—A new distributor, the *INDUSTRIAL SUPPLY CO.*, 1100 Third Ave. S., Minneapolis, Minn.

For *SERVEL, INC.*—The *SUPREME SUPPLY CO.* has been appointed as a distributor of air conditioning equipment for the Southern California area. The new distributor's address is 731 East Hyde Park Blvd., Inglewood, Calif.

For *RADIATOR SPECIALTY CO.*—*O. D. RUSSELL* has been appointed district representative in the Atlanta area and *ROBERT A. BOND* as district representative in the Miami area for the company's "Solder Seal" products.

For the Airtemp Div. of *CHRYSLER CORP.*—Two new franchises to merchandise have been granted. *HAGER and COVER LUMBER CO.* will handle air conditioning equipment in the Lansing, Mich. area. *SOUTHERN PIPE and SUPPLY CO.*, will distribute equipment in the Meridien, Miss. area.

For *GORTON HEATING CORP.*—*LOWELL A. McCORD*, 1017 Trelane, Webster Groves, Mo. has been appointed sales representative in Missouri and southern Illinois.

For *JACKSON & CHURCH CO.*, Furnace Div.—A new factory representative in the Chicago area. *RICHARD J. HOOVER* is in charge of offices at 6022 Woodlawn St.

For *RCA VICTOR*, Div. of Radio Corp. of America—*J. H. SEIPPEL* has been named field sales representative in the southern region, with headquarters in Atlanta.

For *BARBER-COLMAN CO.*—A factory branch office in Columbia, S. C. with *ROBERT LINDSAY* as branch manager. The new office is located at 537 Harden St.

For *UNITED STATES AIR CONDITIONING CORP.*—The *STANDARD DISTRIBUTING CO.*, 227 East Cevallos St., San Antonio, Texas, is a new distributor for the company's store conditioner line. The distributing

It's the *LOW DOWN* DIRT trapped by WILSON'S HAIR FILTERS that GUARANTEES LONGER LIFE

In Wilson *Hair* Filters the entire dust-holding capacity is completely utilized. This means, *no surface dust stopping only*, but Full-Depth Dust Trapping at its best . . . and many extra months of filter life.

The *reasons* are so simple:

1. The hair media in Wilson *Hair* Filters act in the same manner as Mother Nature's proven way of filtering the air you breathe. It's the *hair* that cleans the air . . . more easily, more effectively, more economically.
2. The multi-directional distribution of the hair in Wilson *Hair* Filters literally invites all dust and dirt to come in and be trapped throughout the entire filter interior.
3. Most brands of air filters require oiling on their inlet surfaces. This stops dust prematurely, loads up the incoming air side and materially shortens filter life.

Wilson Hair Filters are not oiled on the inlet side. Instead, they receive an even distribution of mineral oil *on their outlet surface*, which:

(a) augments the already amazing ability of the hair itself, to catch and hold dust, and—

(b) builds an impregnable barrier which halts dust and dirt after reaching the furthermost practicable penetration point.

WILSON & CO., INC.
(Air Filter Division) 4100 South Ashland Ave., Chicago 9, Ill.

Wilson Hair Filters are another quality product of Wilson & Co., world-famous for meat products, sports equipment, pharmaceuticals, hair products, etc.

The famous Edgeseal, the original *Hair* Filter with the patented self-sealing edge.

The popular Honeycomb, the dressed up *Hair* Filter that is so easy to handle.

Save delay. Save dollars. Save doubt. Send for FREE sample with details and prices.

INDOOR COMFORT

WILSON'S HAIR FILTER

WILSON & CO

Darling it's so exciting . . .

I just can't wait

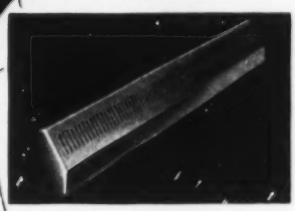
to see those sensational, new

STANDFORATED

Perimeter Baseboard Registers

WITH SLIDING DAMPER CONTROL

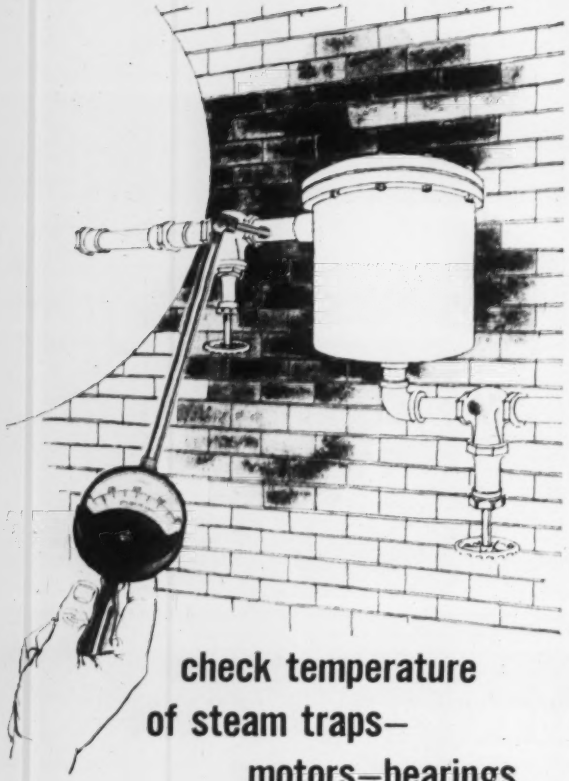
Write Now for Your Free Copy of Standard's Amazing New Pocket Catalog



- Used in homes, schools, churches and commercial installations.
- Comes in four foot sections.
- Simplifies balancing of heating systems.
- Fabricated of 20 gauge steel.
- Finished with Prime Coat only—special finishes on request.

Standard Stamping & Perforating Co.

3151 WEST 49th PLACE, CHICAGO 32, ILLINOIS



check temperature of steam traps— motors—bearings

. . . quickly and accurately with the Alnor Pyrocon, the portable contact pyrometer for taking surface temperatures. This handy, portable instrument can be your most useful maintenance and installation tool . . . it provides accurate temperature readings instantly of any surface (metallic or non-metallic), flat, curved, stationary or revolving.

It's a well-balanced instrument mounted in a sturdy case for protection against the usual hazards of on-the-job service. Jeweled movement is also heavy-duty, shock-resistant type that will withstand hard and continuous use . . . performing with laboratory accuracy.

A wide selection of thermocouples and extension arms assures its adaptation to your needs. Eight standard F. scale ranges are available up to 1200°F. Send for complete details contained in Bulletin 4257. Illinois Testing Laboratories, Inc., Rm. 513, 420 N. LaSalle St., Chicago 10, Ill.

Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY

company will cover the southwest Texas territory. *H. A. PIETSCH CO.*, 894 Heckler Drive, Pittsburgh, has been named manufacturer's representative for western Pennsylvania, West Virginia and eastern Ohio.

For the *McINTIRE CO.*—*R. D. HOLLINGSWORTH* has been appointed district representative in the Ohio, Indiana, and Michigan area.

For *WHEELCO INSTRUMENTS DIV., BARBER COLMAN CO.*—New service engineers and their territories are: *JAMES HEINLEN*, Cincinnati; *JAMES J. HOFFMAN, JR.*, Cleveland; *D. J. PAKER*, Omaha, and *VERNON N. JENNINGS*, Tulsa.

For *KRAMER TRENTON CO.*—The *A. J. NELSON CO.* of Denver, mountain states sales representative, has announced the appointment of *LEON S. BUSH* and *W. H. MITCHELL* to the sales staff. Mr. Bush will cover the territory of Utah, Idaho, western Montana and Arizona. Mr. Mitchell's territory includes Colorado, New Mexico, El Paso, Texas; western South Dakota, western Nebraska, Wyoming and western Montana.

For *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—Several field staff changes. *DOUG RIDLEY*, formerly branch manager of the New Orleans sales office, now is commercial sales manager of the southwest region; *HANK LEICHTENBERG*, former district manager at Madison, Wis., succeeds Mr. Ridley at the New Orleans sales office; *NORM RUTGERS* is branch manager at Des Moines, Iowa, succeeding *WAYNE PETERSON* who becomes branch manager at Hartford; *JOHN FEIGENBAUM*, formerly branch manager at Hartford, is taking on a special assignment there for the company's heating controls division; *BILL STUEWE* has been appointed branch manager in Salt Lake City, succeeding *ELDON RICHARDSON*, who was transferred to the company's executive offices in Minneapolis as home market supervisor. *ED BRUDER*, regional office manager of the central region at Cleveland, has been transferred to New York in a similar capacity.

For *WHEELCO INSTRUMENTS DIV., BARBER-COLMAN CO.*—New locations have been announced for several Wheelco offices. New addresses and those men in charge are: Boston area, 435 Newtonville Ave., Newtonville 60, Mass., *ED W. HEFFERNAN;* New York area, 66 Hudson St., Hoboken, N. J., *HERB PROSKE;* Baltimore area, 338 E. 25th St., Baltimore 18, *WILLIAM KARSLO;* Philadelphia area, 1433 W. Erie Ave., Philadelphia 40, *JOSEPH W. HANCOCK;* Chicago area, 2561 N. Clark St., Chicago 14, *HAROLD F. DAHLKE;* Rock Island area, 3714 14th Ave., Rock Island, Ill., *H. C. REIMERS;* Springfield, Ill. area, 1011 Ridgely Bldg., Springfield, *KEN COATES;* Rockford, Ill. area, 1300 Rock St., Rockford, *VIC LATHERS;* Houston area, 1951 Richmond Ave., Houston 6, *GEORGE H. HATFIELD;* Montreal area, 6693 Park Ave., Montreal 15, P. Q., Can., *GEORGE KNOWLER.*

In the item which appeared on page 262 of the May HPAC, unfortunately it was not stated that these offices were for the Wheelco Div. of Barber-Colman Co.

A. TYPE B2
B. TYPE B4
C. TYPE B3A

SENSITIVE ROOM TYPE THERMOSTATS FOR DOMESTIC OR INDUSTRIAL USE

The three wall mounting thermostats illustrated, provide precise, sensitive control for domestic or industrial heating, air conditioning or cooling systems. Enclosed in smartly styled housings, they will fit into the decorative schemes of homes, offices or industrial plants. Two of the controls, the Type B2 and Type B3A are available in skeleton form for applications which do not require an enclosure. The specifications for the Type B2, B3A and B4 are covered by Bulletin #1-1. Send for it today.

UNITED ELECTRIC CONTROLS COMPANY
87 School Street, Watertown, Mass.

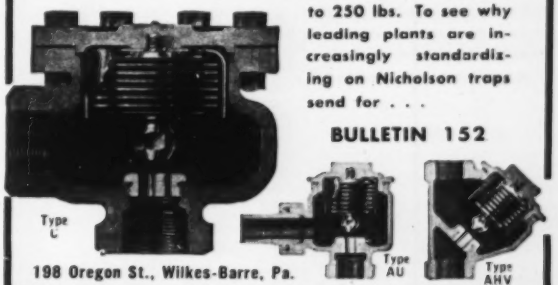
STANDARD & SPECIAL THERMOSTATS & PRESSURE SWITCHES

Nicholson Steam Traps

STOP AIR BINDING, Raise temperature 35°

Equipment temperatures were 30° to 40° higher after Nicholsons replaced mechanical traps in his plant, according to Chief Engineer H.F.D. He also reports faster warm-up, stating that all air-binding was relieved. And "saving in steam waste cut our fuel cost at least 10%". 5 types for process, heat, power. Sizes, ¼" to 2"; press. to 250 lbs. To see why leading plants are increasingly standardizing on Nicholson traps send for . . .

BULLETIN 152



198 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

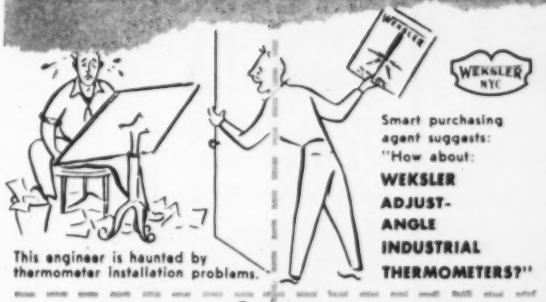
TRAPS · VALVES · FLOATS

√ Check your needs . . .

- ☐ Personnel
- ☐ Equipment Sales
- ☐ Equipment Needs
- ☐ Manufacturers Agents
- ☐ Lines, etc.

Whatever your needs in any of the above classifications . . . you can solve them quickly with a classified advertisement. The space rates are reasonable and results are quick. Closing date— the tenth of the month preceding issue.

The Case Of The Haunted Engineer

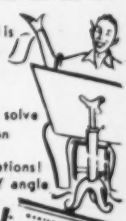


This engineer is haunted by thermometer installation problems.

Smart purchasing agent suggests: "How about: WEKSLER ADJUST-ANGLE INDUSTRIAL THERMOMETERS?"

"Hello, WEKSLER?" Engineer goes into action! "Send over plenty of ADJUST-ANGLE INDUSTRIAL THERMOMETERS!"

The bottleneck spell is broken. WEKSLER ADJUST-ANGLE INDUSTRIAL THERMOMETERS solve all plant installation problems without complicated calculations! They adjust to ANY angle through a 180° arc!



Today—find out how WEKSLER can make things smoother in YOUR plant! Ask your jobber for Important Free Bulletin AA50 or write to:

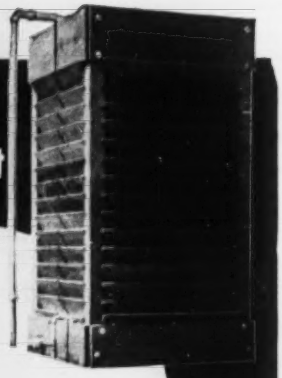
"Industrial America's Right Arm"

WEKSLER THERMOMETER CORPORATION

Martinique Bldg

49 W. 32nd St., New York 1, N. Y.

For Industrial Thermometers Send for Catalog 125.
For Glass Engraved on Stem Thermometers and Hydrometers, Send for Catalog 225.
For Dial Indicating and Recording Pressure Gauges, Send for Catalog 525.
For Dial Indicating and Recording Thermometers, Send for Catalog 325.



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Natural Draft

Accepted by the air conditioning, refrigeration and processing industries as the best buy for lasting economy. Entire construction is of heart redwood. Balanced spray system uses patented Marley non-clog spray nozzles. A wide range of commercial and residential sizes stocked in 30 cities for immediate delivery.

Call Your Local Marley Representative

MARLEY **The Marley Company**
Kansas City, Missouri

—JEFFERSON—

AIR TESTED MALLEABLE IRON

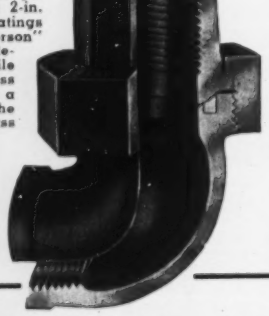
UNIONS

Plainly Marked for Your Protection

Be sure to look for the cast-in-metal "JEFFERSON" and the figures giving rated working pressure and size, before you buy unions. These markings are for your protection . . . . to assure your getting genuine "JEFFERSONS" and to help you check the right size you need for a given use.

Remember this: "JEFFERSONS" are Underwriters' approved for 2000 psi non-shock O.W.G. in sizes to 2-in. and 1000 psi to 4". These ratings are the result of such "Jefferson" features as: air furnace malleable iron having a tensile strength of 55,000 psi, seamless drawn steel tubing seat rings, a truly spherical ball joint and the exclusive Jefferson Recessed Brass Seat.

Jefferson also manufactures: AAR male and female unions, Enduro 300#, Excel 250# and Master 150# unions. All types are also available with all-iron seats.



Contact your nearest distributor or us direct for your requirements.

JEFFERSON UNION CO.

607 West 26th St., New York 1, N.Y.

35 Fletcher Ave., Lexington, Mass.

65 Gooding St., Lockport, N.Y.

NEW BOOKS & REPORTS

Air Conditioning Manual

A newly revised edition of its *Air Conditioning Manual* has been published by the Trane Co. The present 380-page edition is the 16th printing and the second major revision since 1938.

A new fan chapter has been added to the book to cover fan application and selection, basic fan laws and duct design data and nomenclature. This chapter adds complete information on design of air handling systems for air conditioning.

The manual begins with a presentation of the basic physical laws governing heat and cold and applies these laws to practical problems in air conditioning. A chapter on comfort and physiology of human heat control mechanism illustrates comfort standards. Other chapters on heat gain and loss, properties of air and the psychrometric chart, refrigeration and calculations for the conditioned air supply are among those given in the book on basic air conditioning system design and equipment application.

The text is illustrated with drawings, photographs, charts and graphs. Problems at the end of each chapter show practical applications and answers are given in a separate section. A reference section contains standard tables on air, refrigerants, pipe capacities for refrigerant liquid and vapor, and ducts.

The manual can be purchased from the Trane Co., La Crosse, Wis., for $5.00. The new fan chapter is available separately for $1.00. Persons who purchased the manual in the six-month period prior to publication of the new edition may purchase the new chapter for half price.

Standards for Room Air Conditioners

Publication of the 1953 edition of *Equipment Standards for Room Air Conditioners* has been announced by the Air Conditioning and Refrigerating Machinery Association. Standard 110, "Room Air Conditioners," has been completely revised to keep pace with the latest developments. Included in the new edition of the booklet are specifications for standard equipment, rating and testing, design, construction and safety devices and a detailed section on design operating conditions.

Standard 120, included in the booklet, gives a cooling load estimate form for room air conditioners. Complete instructions are given for using the form on jobs not requiring specific conditions of temperature and humidity.

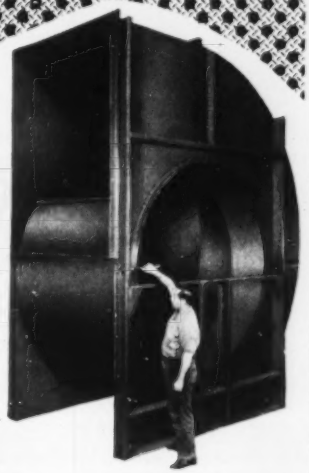
The publication is available from the Air Conditioning and Refrigerating Machinery Association, Southern Building, Washington 5, D.C., at 25 cents a copy.

Pumping of Residual Fuel Oils

In the April 1953 issue of its Bulletin, the American Society for Testing Materials has published a paper on *Laboratory Test for Pumpability of Residual Fuel Oils*. The authors, V. L. Shipp and L. D. Tredick, are members of the Technical Service Department, Socony-Vacuum Laboratories in Brooklyn, N.Y.

The article gives a comprehensive correlation of currently available laboratory tests for predicting the pumpability of heavy waxy fuels and discusses which of these

MASSACHUSETTS
Power Fixed and Squirrel Cage
FANS



POWER FIXED FANS

Backward curve blade type with non-overloading characteristics. Housings constructed of steel plate and reinforced with heavy bracing angles. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia. Class I or Class II construction for better fan selection.

SQUIRREL CAGE FANS

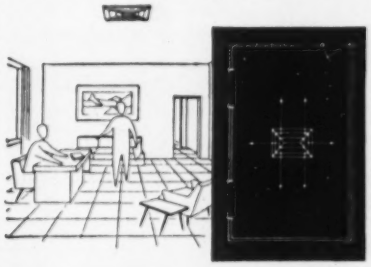
Fan wheels have low speed characteristics. The low air velocities permitted are conducive to efficient operation. Housings are rugged and compact. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia.

Housing shown above for 86½" wheel

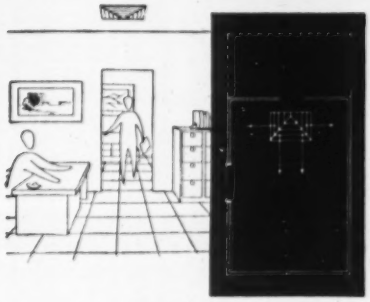
Write for catalogs.

MASSACHUSETTS BLOWER DIVISION
The BISHOP & BABCOCK Mfg. Co.
4901 HAMILTON AVENUE CLEVELAND 14, OHIO

How to be years ahead... overhead!



Today, AGITAIR RC, with 4-way core, provides correct air distribution from room center.



Tomorrow, with walls moved and partitions added, a 3-way AGITAIR core assures correct air distribution from side of room.

The vanes make the difference

AIR DEVICES, INC.
17 E. 42nd St., New York 17, N. Y
AIR DIFFUSERS • FILTERS • EXHAUSTERS

PERFORMANCE MEANS PROFITS!

A assured performance
B bearings—guaranteed
C cost—low
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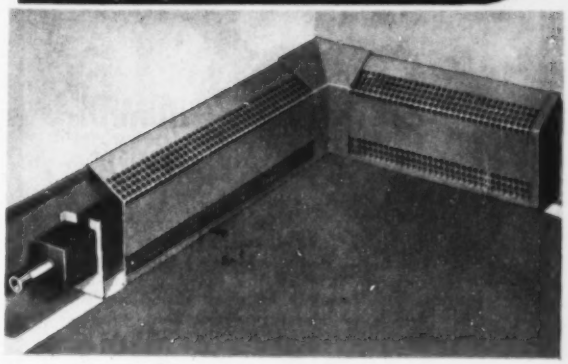
Certified Capacity Ratings of WESTERN ROTARY VENTILATORS sell your customers. See Sweet's Catalog.

Remember — you can't look at a ventilator and judge its value. Western Rotary Ventilators have been thoroughly tested and results published. Check Sweet's, A.E.C. or write for catalog. Features lifetime guaranteed bearings — enduring metallic finish on durable galvanized steel. Throat sizes 6" thru 48". Order from your local dealer. *The complete line of Western ventilating equipment is handled by wholesalers coast to coast.*

"always on the job—never on the payroll"
WESTERN ENGINEERING & MFG. CO.
4118 OCEAN PARK AVENUE, VENICE, CALIFORNIA

New Design "Floor-Level" BASEBOARD CONVECTOR



- **Solves Wall-to-Wall Carpeting Problems**
  Rugs laid up to — not under — cover
- **Directs Warm Air Away From Wall**
  Keeps walls clean
- **Simple Installation**
  New snap-on element hangers solve field alignment problems.

Write today for literature and prices.

REMPE COMPANY
342 N. Sacramento Blvd., Chicago 12, Illinois.

Radiator Traps Built to Last

The above picture shows Chief Engineer William Hillner of Northern Hotel, Billings, Mont., pointing to one of 1281 Sarco type H Radiator Traps which have been in successful service in the hotel for 10 years.

"We have replaced not more than a half dozen elements" says Mr. Hillner, "That's why we again ordered Sarco heating specialties for our 1951 addition of sixty-three rooms."

"We won't accept substitutes."

Yes, you can buy Sarco with confidence. Each trap, before shipment, is carefully tested under actual working conditions.

Sarco Heating Specialties include also radiator valves, air eliminators, boiler return traps, temperature regulators and strainers. Write for Catalog 150-7 to **Sarco Company, Inc.** Empire State Bldg., New York 1, N. Y. No obligation of course. Advt. 609

Monarch

NOZZLES

for

HUMIDI-FYING

Monarch Brass F-80 Air Conditioning Nozzles (or ¼" male one-piece H-261 style) produce the finest possible breakup of small capacities with low direct pressure only. No air required.

The most popular size is #3.00 which operates on as little as 25 pounds pressure, delivers 1.00 gph and produces a very wide angle of spray (120°) in a fine, soft, fog-like mist.

Available in 25 different capacity sizes from .57 gph upwards, all Brass construction with 120 mesh Monel screen strainers.

WRITE FOR CATALOG 6-A

MONARCH MANUFACTURING WORKS, INC.

2523 E. ONTARIO ST. PHILA. 34, PENNA

CANADIAN SALES AGENT (EXCEPT B.C.) CANADIAN GENERAL FILTERS LTD., 2679 DANFORTH AVE., TORONTO 13.

tests correlates most closely with actual full scale pumping.

The tests which have been investigated and compared include: ASTM pour point test, Socony-Vacuum pour point test, I.P. flow test, I.P. setting point, pressure viscosity and the P. and O. fluidity test. A full discussion is presented of the fuel oil pumping installation used in the laboratory.

In addition, several tables are presented showing a comparison of results obtained in laboratory tests and actual tests on the pumpability of Middle East residual fuels.

Among the main conclusions reached by the authors are that competent tests must embody the application of adequate shearing rates and that heat treatment of the product is of paramount importance.

The American Society for Testing Materials is located at 1916 Race St., Philadelphia 3. Single copies of the Bulletin are 50 cents.

OTHER BOOKS AND REPORTS

SYMPOSIUM ON MATERIALS AND DESIGN FOR LIGHTWEIGHT CONSTRUCTION, THE TITANIUM SEMINAR, PB 111083—eight papers presented at a symposium held by the Army's Engineer Research and Development Laboratories. The papers discuss the progress made in developing titanium into a widely used industrial metal. Each paper contains a bibliography. The 95-page mimeographed report is available from the Office of Technical Services, U.S. Dept. of Commerce, Washington 25, D.C., at $2.50.

BASIC MECHANICS OF FLUIDS—a study of the basic principles of kinematics and dynamics as applied to the elementary motion of a fluid. The effect of each essential fluid property is discussed. Authors of the book are Hunter Rouse, professor of fluid mechanics and director of the Iowa Institute of Hydraulic Research and J. W. Howe, professor and head of the Department of Mechanics and Hydraulics, State University of Iowa, Iowa City. Priced at $4.50 a copy, the book has been published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16.

The largest award ever made by *SERVEL, INC.* under its suggestion system was given recently to *HUGH AUSTIN* of Evansville. He received $2300 for his proposal to substitute a new insulating material for the plywood previously used in building "hot room" calorimetric test boxes. Mr. Austin, who has been with the company for 19 years, is a unit time-study supervisor.

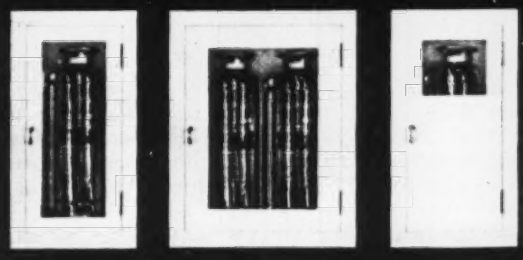
Sales representatives from territories throughout the country recently attended a four-day sales conference at the *KRAMER TRENTON CO.* in Trenton, N. J. Receiving major attention were advancements in engineering and design of new and improved equipment. Production plans for the balance of 1953 were also discussed as well as advertising programs and new literature now being prepared.

Incorporation of the *INDUSTRIAL MINERAL FIBER INSTITUTE of NEW YORK* has been announced by *FRANK CHRISTENSON*, president. It is now a membership corporation of New York State.

for Appearance, *for* Lower Maintenance,
for Emergency Reliability

ALLENCO

FIRE EXTINGUISHER CABINETS



Recessed or Outside Wall Types — 36 Models — 4 Sizes

Cabinet-enclosed extinguishers look better, wear better, discourage tampering and personal injury. And you'll find the best in ALLENCO —voted *first* in interior fire protection by architects, engineers, distributors and contractors.

See SWEET'S . . . write for nearest consulting office and A. I. A. file 29e2

Established 1887

W. D. ALLEN *Manufacturing Co.*

CHICAGO 6 • NEW YORK 7

Now your EARS can "SEE" those hidden troubles

NEW MARSH

Serviceman Soundscope

. . . cuts servicing and maintenance costs

Most effective instrument ever developed for pin-pointing and identifying mechanical defects. Saves time and dollars tracking down troubles in bearings, gears, mechanisms . . . detects leaks, knocks, piston slaps—any defects that make a sound. A precision instrument of Marsh quality, sensitive to faintest sounds . . . with handy probe and headband as illustrated. A remarkable tool, moderately priced.

Ask for Circular

MARSH INSTRUMENT CO.

Sales affiliate of Jas. P. Marsh Corporation

Dept. T, Skokie, Illinois

NEW! HEAVY DUTY

CHELSEA FANS

-for every industrial application!

POWER CHELSEA LINE FANS

• TYPE PLF POWER LINE DIRECT DRIVE — 16" to 48", all H.P. ratings. Square frames for easy mounting.

• TYPE PLDX POWER LINE DUCT BOOSTER — Motor external to air stream. 16" to 48", all H.P. ratings.

• TYPE PLDU POWER LINE AIR BLASTER — For spot cooling — available on pedestal, 18" to 42", all H.P. ratings.

• TYPE PLBD POWER LINE BELT DRIVEN—24" to 48", all H.P. Square frames for easy mounting.

—solve your ventilation problems

with CHELSEA'S new heavy duty airfoil type exhaust fans. For use in exhausting, duct work, filter installations, range or vat hoods, penthouse units, paint spray booths, where static pressure is encountered. All ratings are certified by P.F.M.A. test methods to insure proper performance.

Write for Catalog No. V-6 address Dept. D-9.

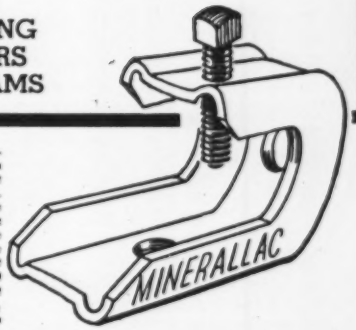
CHELSEA FAN & BLOWER CO., Inc.

PLAINFIELD, NEW JERSEY

MINERALLAC

BEAM CLAMPS

FOR MOUNTING HANGERS ON I-BEAMS



Mounts Minerallac hangers No. 0 to No. 6 on I-Beams safety without necessity of drilling holes. Made of heavy gauge zinc plated steel with deep drawn ribs to give needed strength, these durable, light weight beam clamps have 1/4-20 trapped holes—will fit beam flanges up to 1/2 inch thick. Furnished with case-hardened set screw. Low cost.

Order From Your Electrical Wholesaler

SEND FOR LITERATURE

MINERALLAC ELECTRIC COMPANY

25 North Peoria St. Chicago 7, Ill.

MINERALLAC

The Magic Regulator

WA-TROL

CUTS INSTALLATION COSTS

It's no problem to balance air distribution in half the time at half the cost when you use Wa-Trol, the Modern Regulator. Indicator shows at a glance exact position of damper. A simple twist of the knob gives accurate setting without any tools. Positive locking in any position. Wa-Trol is ideal for heating and air conditioning.

Wa-Trol, Proven in Over 5,000 Installations in First Six Months.

Send Today for Free Sample!

Pat. Pending

WA-TROL

Wa-Trol

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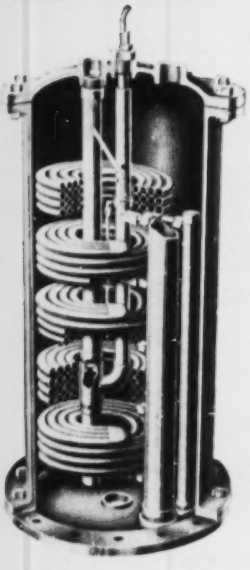
AERCO

COMPACT STORAGE WATER HEATER



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NATIONAL DISTRICT HEATING ASSOCIATION, 827 N. Euclid Ave., Pittsburgh 6 — 44th annual meeting, June 9 to 12, Lookout Mountain Hotel, Chattanooga, Tenn.

FOURTH NATIONAL STORE MODERNIZATION, BUILDING AND MAINTENANCE SHOW, Madison Square Garden, New York, June 9-12 — Sponsored by the Store Modernization Institute, 20 E. 55th St., New York 22, it will cover physical properties and operation of retail stores including warehousing and distribution. Air conditioning and refrigeration will be a featured theme of the show. One of the speakers will be J. F. Knoff, vice president of Chrysler Airtemp, whose topic is, "Let's Clear the Air—What Air Conditioning Can Do for the Retailers."

SEVENTH SHORT COURSE ON HOT WATER AND STEAM HEATING SYSTEMS, University of Illinois, Urbana, June 15-18 — Co-sponsored by the University of Illinois and the Institute of Boiler and Radiator Manufacturers. This course will be similar to previous courses in that it will consist of a combination of classroom work and lectures as a means of presenting the latest material on hot water and steam heating systems.

AMERICAN WELDING SOCIETY, 33 W. 39th St., New York 18. — National Spring Technical Meeting, June 16 to 19, 1953, Shamrock Hotel, Houston, includes a four-day Welding and Allied Industry Exposition in the Shamrock Hall of Exhibits. The exhibits will be presented by manufacturers who sell products for welded fabrication, weldments, welding processing, gas cutting, brazing, finishing, tooling, gaging, testing, stress relieving, x-raying, servicing and handling.

THE NATIONAL HEATING WHOLESALERS ASSOCIATION, 27 E. Monroe St., Chicago 3 — Spring convention, June 22-24, Grove Park Inn, Asheville, N.C.

AMERICAN SOCIETY FOR ENGINEERING EDUCATION—61st annual meeting, June 22-26, University of Florida, Gainesville. Plans call for more than 100 conferences including a series on atomic energy engineering; lectures on digital computers and discussions by industrial economists. General chairman is Prof. John C. Reed, head of mechanical engineering at the University of Florida. The meeting will be preceded by a three-day summer school, beginning June 20, sponsored by the society's industrial engineering division.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18—Spring meeting, June 27-July 1, Lake Placid Club, Lake Placid, N.Y. Some of the papers to be presented at the various technical sessions are: "Year-Round Reflective Radiant Conditioning;" "A Discussion of Air Conditioning Test Facilities;"

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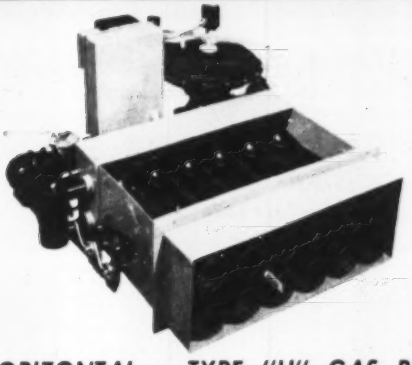

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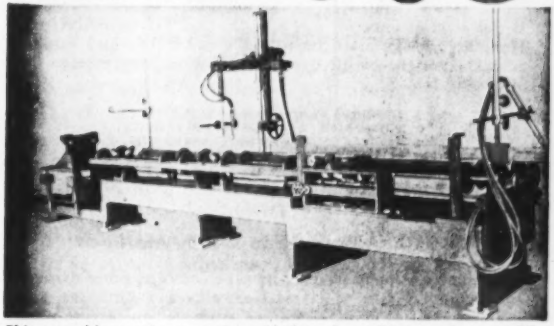

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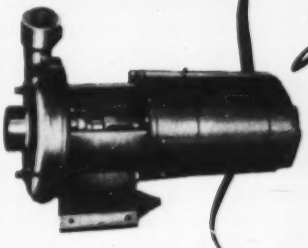

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The 1953 winter meeting will be held in Washington, D. C. and the 1954 semi-annual meeting in Seattle. The December 1954 annual meeting will be held in Philadelphia. This meeting will mark the 25th anniversary of the Philadelphia section and the 50th anniversary of ASRE.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13 — Semi-annual meeting, June 29, 30, July 1, Denver, Colo. For further information see page 127.

AMERICAN SOCIETY FOR TESTING MATERIALS, 1916 Race St., Philadelphia 3—1953 annual meeting, June 29-July 3, Chalfonte-Haddon Hall, Atlantic City. Eight technical symposiums to be presented at the meeting are on: Metallic Materials at Low Temperatures; Fluorescent X-Ray Spectrographic Analysis; Radioactivity in ASTM Work; Techniques for Electron Metallography; Significance of Test of Concrete; Lateral Pile Load Tests; Porcelain Enamels and Ceramic Coatings as Engineering Materials, and Dynamic Testing of Soils.

AMERICAN INSTITUTE OF WHOLESALE PLUMBING & HEATING SUPPLY ASSOCIATIONS — Second annual convention, September 20-23, Waldorf-Astoria, New York. Convention chairman is M. W. Dennison of Braman, Dow and Co., Boston.

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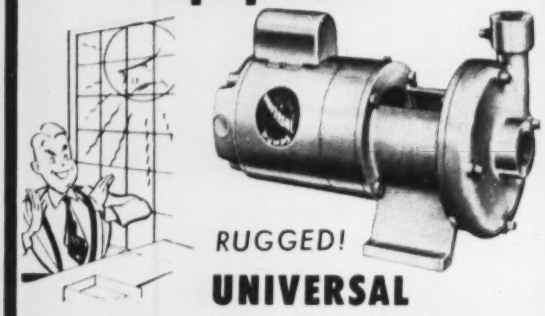

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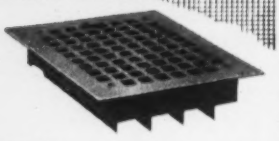

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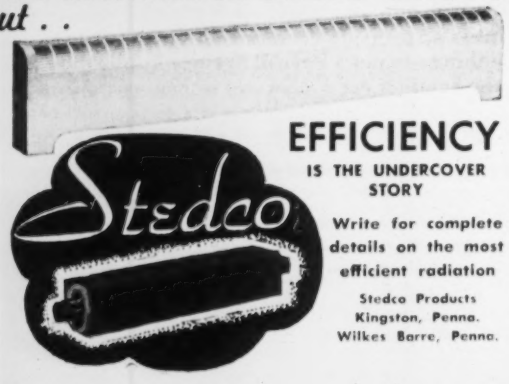

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SOUTH CENTRAL REGION, NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston 2 — October 7-9, Mayo Hotel, Tulsa. This region consists of the states of Colorado, Kansas, Oklahoma, Arkansas, Louisiana, Texas and New Mexico.

NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS — Ninth annual meeting, October 8-9, Sheraton Hotel, Chicago. Sponsored by the Illinois Institute of Technology, Chicago 16, the conference director is Otmar E. Teichmann.

AMERICAN GAS ASSOCIATION, 420 Lexington Ave., New York 17 — 35th annual convention, October 26-28, Kiel Auditorium, St. Louis. Hotel reservations are available from the Hotels Convention Bureau, American Gas Assoc., Rm. 405, 911 Locust St., St. Louis 1.

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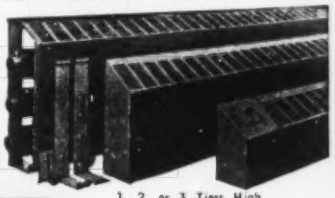

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THEY HEAT AND HUMIDIFY

THEY COOL AND DEHUMIDIFY

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Aside from comfort applications in offices, plants, stores, etc., Multitherm Units are widely used in industry where production depends upon a certain temperature and humidity. Clarage Capillary Conditioners are available for cases where extremely close control is needed to meet requirements.

We welcome your inquiry for any desired information.

CLARAGE FAN COMPANY
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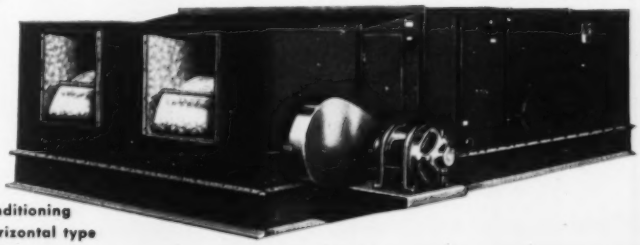

Capillary Conditioning Unit—horizontal type

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CLARAGE

Headquarters for Air Handling and Conditioning Equipment

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • *IN CANADA* Canada Fans, Ltd., 4285 Richelieu St., Montreal

"Your valve is just a weeper!"

(Imagine how we felt!)

That was the complaint entered by the irate voice at the other end of the phone. He was slurring one of our prized temperature relief valves: so we hurried right out to see what was eating the guy.

What we found caused a lot of head scratching. The fellow was righter than right about the weeping, but when we tested out the valve we found it was opening just as it should—at 188° F. The trouble was that it just barely opened, and then, as our friend said, just sat there and wept.

So there's your 32-dollar question: When is a temperature relief valve doing right and wrong at the same time? The answer is that any valve with a dip tube—ours or anybody else's—can become a weeper. But that's getting ahead of the story; let's see what causes this.

First note that the valve under suspicion was one of our combined T&P Relief Valves. Its thermostatic element starts to open at 188° F., is fully opened at 208° F., and closes when the temperature recedes to 183° F. So it takes a 20-degree rise, after it starts, to open it wide.

Now, as we said, this was a dip-tube type—the type that is affected by the temperature about five inches down in the tank. So the water in that zone had reached 188 degrees and had opened the valve just far enough to discharge a small trickle. This caused just enough cold water to flow into the heater to balance the heat dissipated . . . and keep *right on doing it.*

In other words we had a state of equilibrium: Not enough heat to open the valve wide enough to produce (in turn) sufficient cooling to reseat it. Such a condition can of course go on and on—the relief valve simply acting as a heat metering valve—yet the valve would be simply doing what it was designed to do!

Cases like this are not the rule; but they are frequent enough to make us recommend our temperature relief valve *WITHOUT* the dip tube for practically all applications. When the thermostatic element is in the valve body, the temperature of the hottest water in the top of the tank may reach 208° F. before the water surrounding the element reaches 188 degrees, but when the valve *does* open there is enough accumulated heat to open it wide; quickly cool the contents of the tank, and reseat the valve. This is what you want . . . prompt and complete functioning of the valve; not service calls about weepers!

Remember that in the McDonnell T&P Valve a fixture connection is provided right in the valve; so the hot water passes over the thermostatic element every time water is withdrawn. This offers the advantage of service free operation without the drooling. * For your next job use a 202 series valve as described here . . . it gives the owner *maximum* protection on both the pressure and temperature side. A new bulletin tells the whole story.

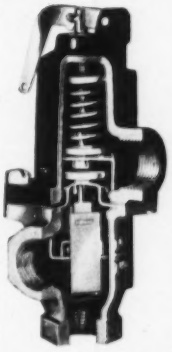
* Our dip tube T&P valve (No. 203) is illustrated opposite. If it is wrong, why do we make it? That's a good question. The first answer is that it isn't wrong itself; it can just "get in" wrong. We make it because certain specifications call for it—apparently for special applications where it is desired to carry temperatures clear up to the setting of the valve, in which case, there is a questionable assumption that the valve operation should be governed by temperature down in the tank. This is a controversial point, but we are continuing the dip-tube pending further engineering analysis.

McDONNELL & MILLER, Inc., 3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

Your Jobber Stocks Them

The ultimate in T&P Valves

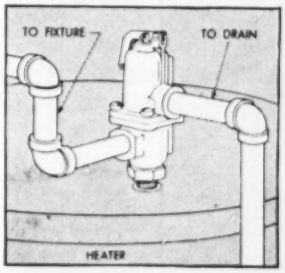


McDONNELL

No. 202

Here is the perfect combination you have been needing for those tanks and heaters. It combines two valves you know to be the best of their types—our No. 230 pressure relief valve and our 201 temperature relief valve. This means that on the pressure relief side the No. 202 is *steam rated* in Btu's per hr. . . . and on the temperature side it embodies the accuracy of response to the McDonnell No. 201 and has the ¾" tapping to fixtures which saves time and money.

Opening pressure: 125 lbs.
Pressure rating: 644,000 Btu/hr.
Temperature range: 188°-208°F.
Temperature rating AGA listed: 725,000 Btu/hr.
All connections: ¾" tappings



Note fixture tapping which brings service water through body of valve assuring control of water temperature as used.

McDONNELL *Boiler Safety Devices*